THE AMERICAN PHILOSOPHICAL SOCIETY

HELD AT PHILADELPHIA
FOR PROMOTING USEFUL KNOWLEDGE

YEAR BOOK 1940

JANUARY 1, 1940 – DECEMBER 31, 1940

THE AMERICAN PHILOSOPHICAL SOCIETY
INDEPENDENCE SQUARE
PHILADELPHIA
1941

LANCASTER PRESS, INC., LANCASTER, PA.

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I

CHARTER *

Statutes at Large of Pennsylvania

CHAPTER DCCCXCIV.

AN ACT

for incorporating the American Philosophical Society held at Philadelphia for promoting useful knowledge.

L.S.

Whereas the cultivation of useful knowledge, and the advancement of the liberal arts and sciences in any Country, have the most direct tendency towards the improvement of agriculture, the enlargement of trade, the ease and comfort of life, the ornament of society, and the encrease and happiness of mankind; **And whereas** this country of North America, which the goodness of Providence hath given us to inherit, from the vastness of its extent, the variety of its climate, the fertility of its soil, the yet unexplored treasures of its bowels, the multitude of its rivers, lakes, bays, inlets, and other conveniences of navigation, offers to these United States one of the richest subjcts of cultivation, ever presented to any people upon earth; **And whereas** the experience of ages shows that improvements of a public nature, are best carried on by societies of liberal and ingenious men, uniting their labours, without regard to nation, sect or party, in one grand pursuit, alike interesting to all, whereby mutual prejudices are worn off, a humane and philosophical spirit is cherished, and youth are stimulated to a laudable diligence and emulation in the pursuit of wisdom; **And whereas**, upon these principles,

* Original Charter, Granted in 1780. Articles of Amendment added 1935.

divers public-spirited gentlemen of Pennsylvania and other American States did heretofore unite themselves, under certain regulations, into one voluntary Society, by the name of "The American Philosophical Society held at Philadelphia, for promoting useful knowledge," and by their successful labours and investigations, to the great credit of America, have extended their reputation so far, that men of the first eminence in the republic of letters in the most civilized nations of Europe have done honour to their publications, and desired to be enrolled among their members; **And whereas** the said Society, after having been long interrupted in their laudable pursuits by the calamities of war, and the distresses of our Country, have found means to revive their design, in hopes of being able to prosecute the same with their former success, and being further encouraged therein by the public, for which purpose they have prayed us, "the Representatives of the Freemen of the Commonwealth of Pennsylvania," that they may be created One Body Politic and Corporate forever, with such powers, privileges, and immunities, as may be necessary for answering the valuable purposes which the said Society had originally in view.

Wherefore, in order to encourage the said Society in the prosecution and advancement of all useful branches of knowledge, for the benefit of their country and mankind.

[Section I.] **Be it enacted, and it is hereby enacted by the Representatives of the Freemen of the Commonwealth of Pennsylvania, in General Assembly met, and by the authority of the same,** That the Members of the said American Philosophical Society heretofore voluntarily associated for promoting useful knowledge, and such other persons as have been duly elected Members and Officers of the same, agreeably to the fundamental laws and regulations of the said Society, comprized in twelve sections, prefixed to their first volume of transactions, published in Philadelphia by William and Thomas Bradford in the year of our Lord one thousand seven hundred and seventy-one, and who shall in

all respects conform themselves to the said laws and regulations, and such other laws, regulations and ordinances, as shall hereafter be duly made and enacted by the said Society, according to the tenor hereof, be and forever hereafter shall be, One Body Corporate and Politic in Deed, by the name and style of "The American Philosophical Society held at Philadelphia, for promoting useful knowledge," and by the same name they are hereby constituted and confirmed One Body Corporate and Politic, to have perpetual succession, and by the same name they and their successors are hereby declared and made able and capable in law, to have, hold, receive, and enjoy lands, tenements, rents, franchises, hereditaments, gifts, and bequests of what nature so ever, in fee simple or for term of life, lives, years or otherwise, and also to give, grant, let, sell, alien, or assign the same lands, tenements, hereditaments, goods, chattels, and premises, according to the nature of the respective gifts, grants, and bequests, made to them the said Society, and of their estate therein. **Provided**, that the amount of the clear yearly value of such real estate do not exceed the value of ten thousand bushels of good merchantable wheat.

[Section II.] **And be it further enacted by the authority aforesaid**, That the said Society be, and shall be for ever hereafter able and capable in law to sue, and be sued, plead and be impleaded, answer and be answered unto, defend and be defended in all or any of the courts or other places, and before any Judges, Justices, and other person or persons, in all manner of actions, suits, complaints, pleas, causes, and matters, of what nature or kind so ever, within this Commonwealth; and that it shall and may be lawfull to and for the said Society, for ever hereafter to have and use one common seal in their affairs, and the same at their will and pleasure to break, change, alter and renew.

[Section III.] **And be it further enacted by the authority aforesaid**, That for the well governing of the said Society, and ordering their affairs, they shall have the following officers, that is to say, one Patron, who shall be his

Excellency the President of the Supreme Executive Council * of this Commonwealth, for the time being, and likewise one President, three Vice Presidents, four Secretaries, three Curators, one Treasurer, together with a Council of twelve members; and that on the first Friday of January next, between the hours of two and five in the afternoon, as many of the members of the said Society as shall have paid up their arrears due to the Society, and shall declare their willingness to conform to the laws, regulations and ordinances of the Society then duly in force, according to the tenor hereof, by subscribing the same, and who shall attend in the Hall or place of meeting of the said Society, within the time aforesaid, shall chuse by ballot, agreeable to the fundamental laws and regulations herein before referred to, one President, three Vice Presidents, four Secretaries, three Curators, and one Treasurer, and at the same time and place, the members met and qualified as aforesaid shall in like manner chuse four members for the Council, to hold their offices for one year, four more members for the Council to hold their offices for two years, and four more members for the Council, to hold their offices for three years. And on the first Friday in January, which shall be in the year of our Lord one thousand seven hundred and eighty-two, and so likewise on the first Friday of January, yearly and every year thereafter, between the hours of two and five in the afternoon, the Members of the said Society met and qualified as aforesaid, shall chuse one President, three Vice Presidents, four Secretaries, three Curators and one Treasurer, to hold their respective offices for one year, and four Council Men to hold their offices for three years: *Provided* that no person residing within the United States shall be capable of being President, Vice President, Secretary, Curator, Treasurer, or member of the Council, or of electing to any of the said offices, who is not capable of electing and being elected to civil offices within the State in which he resides. *Provided also,* that nothing herein

* [Now His Excellency the Governor of this Commonwealth.]

contained shall be considered as intended to exclude any of the said Officers or Councillors, whose times shall be expired, from being re-elected, according to the pleasure of the said Society; and of the day, hours and place of all such elections, due notice shall be given by the Secretaries, or some one of them, in one or more of the public newspapers of this State, agreeable to the said fundamental laws and regulations before referred to.

[Section IV.] **And be it further enacted by the authority aforesaid**, That the Officers and Council of the said Society shall be capable of exercising such power for the well governing and ordering the affairs of the Society, and of holding such occasional meetings for that purpose, as shall be described, fixed, and determined by the statutes, laws, regulations and ordinances of the said Society, hereafter to be made. *Provided always*, that no statute, law, regulation or ordinance shall ever be made or passed by the said Society, or be binding upon the members thereof, or any of them, unless the same hath been duly proposed, and fairly drawn up in writing, at one stated meeting of the Society, and enacted or passed at a subsequent meeting at least the space of fourteen days after the former meeting, and upon due notice in some of the public newspapers, that the enacting of statutes and laws, or the making and passing ordinances and regulations, will be part of the business of such meeting; nor shall any statute, law, regulation or ordinance be then or at any time enacted or passed, unless thirteen members of the said Society, or such greater number of members as may be afterwards fixed by the rules of the Society, be present, besides such quorum of the Officers and Council, as the laws of the Society for the time being may require, and unless the same be voted by two-thirds of the whole body then present; all which statutes, laws, ordinances and regulations, so as aforesaid duly made, enacted and passed, shall be binding upon every member of the said Society, and be from time to time inviolably observed, according to the tenor and effect thereof; pro-

vided they be not repugnant or contrary to the laws of this Commonwealth, for the time being in force and effect.

And whereas nations truly civilized (however unhappily at variance on other accounts) will never wage war with the Arts and Sciences, and the common Interests of humanity:

[SECTION V.] **Be it further enacted by the authority aforesaid,** That it shall and may be lawful for the said Society by their proper officers, at all times, whether in peace or war, to correspond with learned Societies, as well as individual learned men, of any nation or country, upon matters merely belonging to the business of the said Society, such as the mutual communication of their discoveries and proceedings in Philosophy and Science; the procuring books, apparatus, natural curiosities, and such other articles and intelligence as are usually exchanged between learned bodies, for furthering their common pursuits; **Provided always,** That such correspondence of the said Society be at all times open to the inspection of the Supreme Executive Council of this Commonwealth.

[Signed] *JOHN BAYARD,*
Speaker.

Enacted into a Law at Philadelphia on Wednesday the fifteenth day of March anno Domini one thousand seven hundred and eighty.

[Signed] *THOMAS PAINE,*
Clerk of the General Assembly.

COMMISSION FOR THE COMPILATION OF THE LAWS OF PENNSYLVANIA PRIOR TO 1800.

CLERK'S OFFICE,
1211 BETZ BUILDING.

JAMES T. MITCHELL, HENRY FLANDERS, } *Commissioners.* CHAS. R. HILDEBURN, *Clerk.*

PHILADELPHIA, March 12, 1898.

Compared, revised and found to be a correct copy of the original enrollment in the archives of the Commonwealth, by me the custodian of the said original as clerk of the commissioners appointed under the act of May 19, 1887, entitled, AN ACT FOR THE COMPILATION AND PUBLICATION OF THE LAWS OF THE PROVINCE AND COMMONWEALTH OF PENNSYLVANIA PRIOR TO THE YEAR ONE THOUSAND EIGHT HUNDRED, P.L. 1887, pp. 129 and 130.

CHAS. R. HILDEBURN,
Clerk of the Commissioners.

Witness as to Chas. R. Hildeburn:

WM. NEWBOLD ELY,
JULIUS F. SACHSE.

SEAL Sworn to and subscribed before me this 19th day of May, 1898.

JAMES P. STERRETT,
Chief Justice of the Supreme Court of Pennsylvania.

ARTICLES OF AMENDMENT

Article I

Notwithstanding the Proviso at the end of the first paragraph following the preamble of this Charter, or any other proviso thereof, the Society shall have the capacity and authority without limitation by this Charter to purchase, take, receive, lease as lessee, take by gift, devise or bequest, or otherwise acquire, and to own, hold, use, and otherwise deal with any and all real or personal property, or any interest therein, wherever situated.

Article II

Any provisions of this Charter which are purely administrative in their nature, including those concerning the officers, the members of the council, and the date and time of meetings, may be altered by a law, regulation or ordinance of the Society duly adopted and not repugnant or contrary to the laws of this Commonwealth.

CERTIFICATE OF ACCEPTANCE

1. The name of the accepting corporation is The American Philosophical Society held at Philadelphia for promoting useful knowledge.
2. The American Philosophical Society was created by the Act of Assembly approved March 15, 1780, L.B. No. 1, 363.
3. The American Philosophical Society herewith accepts the Constitution of Pennsylvania and the provisions of the Nonprofit Corporation Law.
4. The acceptance made herewith was duly authorized by a meeting of the members called for that purpose, held in Philadelphia on the 6th day of December, 1935.

Roland S. Morris
President

C. F. Skinker
Assistant Secretary

SEAL Filed this 12th day of
December, 1935
J. Warren Mickle
Deputy Secretary of the Commonwealth
Recorded in
Miscellaneous Corporation
Record Book 210, P. 125

II

LAWS

(As Amended April 24, 1936, April 22, November 19, 1938, and November 18, 1939)

Chapter I

Of the Members both resident and foreign: their classification, nomination, and election; suspension and forfeiture of membership.

Art. 1. The resident members of the Society are elected from among citizens or residents of the United States who have achieved distinction in the sciences or humanities, in letters, in the practice of the arts or of the learned professions, or in the administration of affairs. Their number may not exceed five hundred, nor may more than thirty be elected in any one year.

Art. 2. The foreign members of the Society are elected from among persons who are neither citizens nor residents of the United States, and who are of the greatest eminence for their attainments in science, letters, or the liberal arts. Their number may not exceed sixty, nor may more than eight be elected in any one year.

Art. 3. Every member, whether resident or foreign, shall be classified according to his expressed wishes, or in accordance with his principal activities or contributions to knowledge, in one of the following four classes: *

* In accordance with general usage, the following more or less clearly defined fields of science and learning within the four classes have been recognized by the Society in recent years: Class I. Mathematics; Astronomy; Physics; Chemistry; Engineering. Class II. Geology, Paleontology, Geography; Zoology, Anatomy; Botany, Bacteriology; Anthropology, Psychology; Physiology, Pathology; Medicine, Pharmacology, Surgery. Class III. Political Science, Economics and Statistics; Modern History; Jurisprudence; Administration, Government; Affairs. Class IV. Philosophy, Education; Ancient, Medieval and Cultural History; Archaeology; Philology and Languages; Literature, Fine Arts.

Class I. Mathematical and Physical Sciences
Class II. Geological and Biological Sciences
Class III. Social Sciences
Class IV. Humanities

Art. 4. In each of the four classes of members there shall be a Committee on Membership consisting of a Chairman and four other members, appointed by the President.

Art. 5. Nominations to membership shall be made in writing by the Committees on Membership, or they may be made by any five members of the Society. These nominations shall be known respectively as "Committee nominees," and "Member nominees," and shall be so listed in the *preliminary ballot*. These nominations must be in the Executive Office before December first. Nominations shall be on blank forms provided for that purpose and shall specify the qualifications and principal activities or fields of learning of the nominees. In case of non-election nominations may be continued by the written endorsement of three of the proposers filed in the Executive Office before November first following and shall be listed as "Continued nominations" in the *preliminary ballot;* these nominations may be continued a second time in similar manner, after which the names of the unsuccessful candidates will be dropped and all papers relating thereto destroyed. Such candidates may be considered again only by entirely new nominations.

Art. 6. Immediately after December first in each year the Chairman of each Committee on Membership shall submit to the members of his class a list of all the nominations in the class and shall request them to use this list as a *preliminary ballot* and to check on it the names of those persons, not more than twelve in number, whom they prefer for resident members, and not more than five whom they prefer for foreign members, and to sign and return this ballot to the Executive Office before January first.

Art. 7. Before February first each Committee on Membership shall select from among those nominees having a

high number of votes in the *preliminary ballot* not more than twelve for resident membership and not more than five for foreign membership in each class, due regard being given to a proper representation of the various subjects within the class.

ART. 8. Before February first, the Council may nominate not more than three persons in each year whose names shall be presented to the Society in the *preference ballot* as "Council nominees" together with their qualifications. These nominations shall be on the regular blank forms provided for that purpose.

ART. 9. It shall be the duty of each Committee on Membership to prepare, with such outside assistance as it may choose, a brief biographical sketch of each of the nominees so selected, listing his profession, position, qualifications, and important publications or contributions to science, literature, art or affairs. The names of these nominees, together with the biographical sketch of each, shall then be printed in alphabetical order under each class, and shall be sent confidentially to all members of the Society not later than March first. Members shall be invited to return to the Executive Office before April first a *preference ballot* on which they have checked the names of not more than thirty nominees for resident membership and of not more than eight for foreign membership.

ART. 10. The Council at the meeting next preceding the General Meeting of the Society in the month of April, notice of which shall be given at least two weeks in advance, shall select by ballot from the list of nominees residing within the United States a number not exceeding thirty, and of non-residents of the United States a number not exceeding eight, to be recommended to the Society for election. In this selection special weight shall be given to the votes of members in the preference ballot. The names of the nominees so chosen, arranged alphabetically in classes, shall be reported to the Society at its next ensuing session.

ART. 11. Election to membership, both resident and foreign, shall be by ballot at the General Meeting of the Society in the month of April. A two-thirds vote of those present and voting shall be necessary to elect.

ART. 12. The members are mutually pledged not to mention to non-members of the Society the name of any nominee proposed, or of any withdrawn or unsuccessful nominee.

ART. 13. Every person who is elected a resident or foreign member shall signify his acceptance in writing within one year after the mailing of notification of such election. In default of such acceptance the election shall be void.

ART. 14. The formal admission of a member into the Society shall be at his first attendance at a meeting of the Society after his election and in the manner and form following: He shall subscribe the Laws in the Roll Book and be introduced to the President, who, taking him by the hand, shall say:

"By the authority and in the name of the American Philosophical Society held at Philadelphia for Promoting Useful Knowledge, I do admit you a Member thereof."

ART. 15. The Society may from time to time assess membership dues in accordance with its needs and policies. Any person who shall refuse or neglect to pay such assessment for two years, after two or more notifications from the Treasurer, shall be reported to the Society as delinquent and his name shall be stricken from the roll of members.

ART. 16. The membership of any resident or foreign member may, for good and sufficient cause, and upon recommendation by the Council, be terminated by the Society at a General Meeting by a vote of two-thirds of the members attending, provided, however, that the total number of members so attending shall be not less than thirty.

CHAPTER II

Of the Patron and Elective Officers; qualifications, nominations and elections, terms of office, suspension or removal, vacancies.

ART. 1. The Governor of Pennsylvania shall be ex-officio the Patron of the Society.

ART. 2. The elective Officers of the Society shall be a President, three Vice-presidents, two Secretaries, a Curator, a Treasurer, and twelve Councillors.

ART. 3. No person save the Treasurer, who may be a Corporation, shall be capable of holding any elective office as defined above, who is not a citizen of the United States.

ART. 4. Nominations to the elective offices of the Society are made by the Committee on Nominations as hereinafter provided, and may also be made by petition signed by not less than twenty members, in such manner as may be prescribed by the Committee on Nominations and approved by the Council.

ART. 5. The election of Officers shall be held at the General Meeting in the month of April at a time duly announced in the program. The election shall be by ballot, a majority of all ballots cast being requisite for election. In the event that no candidate for a given office shall receive such a majority, a second ballot shall be taken and election shall be by plurality of votes cast.

ART. 6. The terms of all elective Officers, except Councillors, are of one year, commencing upon the close of the General Meeting at which they are elected. They shall serve until the election and acceptance of their successors and are eligible for reelection.

ART. 7. The terms of Councillors are of three years, commencing upon the close of the General Meeting at which they are elected. They shall serve until the election and acceptance of their successors, but are ineligible for reelection until one year after the expiration of their terms of office.

ART. 8. Any elective Officer may be suspended or removed from office, for good and sufficient cause, at a meeting of the Council, by a vote of two-thirds of all its members.

ART. 9. A vacancy occurring in any elective office may be filled for the unexpired term by vote of a majority of the Council.

CHAPTER III

Of the Officers and their duties

ART. 1. The PRESIDENT shall preside at the meetings of the Society and Council; he shall appoint all committees, and designate their chairmen, except as otherwise provided in the Laws, and shall be ex-officio a member of all committees except the Committee on Nominations.

ART. 2. The VICE-PRESIDENTS shall preside at meetings of the Society and Council, in the absence of the President, in rotation in order of seniority of continuous service. In the event of the death or disability of the President, the senior Vice-president shall act as President until the vacancy shall be filled.

ART. 3. The SECRETARIES shall have the custody of the Seal of the Society, shall record the proceedings of the Society and the Council, shall notify all acts of the Society and the Council to those concerned, shall conduct the correspondence of the Society and Council, shall maintain the authentic list of resident and foreign members, and shall have the custody of the Society's files and records. The Secretaries shall arrange among themselves each year as to the distribution and performance of their duties, and shall report such arrangement to the Council; they shall also have power to delegate the performance of their duties to the Assistant Secretary or Executive Officer.

ART. 4. The CURATOR shall have charge of the Cabinet, and shall supervise the maintenance, exhibit, and use of the Society's collections, and shall advise the Council with

respect to their increase, disposal, or temporary loan. He shall be ex-officio a member of the Committee on the Hall.

ART. 5. The TREASURER may be a person, as defined in Chap. II, Art. 3, or a trust company or other suitable financial corporation of the State of Pennsylvania. He shall collect and receive all moneys due or payable to the Society or entrusted to its care, and all gifts and bequests made to it. He shall pay all bills due by the Society when properly approved, in accordance with appropriations authorized by the Society or the Council, or in accordance with the terms of trust funds established for specific purposes. He shall deposit the funds and securities of the Society in its name with such banks or trust companies in the State of Pennsylvania as may be approved by the Committee on Finance.

ART. 6. The Treasurer shall keep accounts in good and regular order of all receipts and expenditures and of all moneys or other property in his hands, and shall report them, and present them for audit, as may be required by the Committee on Finance.

ART. 7. The Treasurer may, if authorized by vote of the Committee on Finance, employ an assistant treasurer or a trust company or other suitable financial corporation of the State of Pennsylvania, approved by the Committee on Finance, for the performance of such duties as may be delegated to such agent.

ART. 8. The Treasurer shall give bond, at the expense of the Society, for the faithful execution of all his trusts, in such amount as may be required by the Committee on Finance.

ART. 9. The Treasurer shall, upon the expiration of his term of office, deliver over to the Committee on Finance, for transmittal to his successor, the books, papers, moneys, and property remaining in his hands.

Chapter IV

Of the Council and the Annual Budget

Art. 1. The Council shall consist of the Officers, the twelve Councillors, and the Chairmen of the Committees on Finance, Research, Publications, Library and Hall.

Art. 2. The Council shall hold at least two meetings a year, and nine members shall constitute a quorum at any meeting, provided, however, that for the adoption of the budget a vote of a majority of all the members shall be requisite. Minutes of the proceedings and acts of the Council shall be regularly kept.

Art. 3. The Council shall make recommendations for membership in the Society as provided in Chap. I, Art. 9, of the Laws, and elect members of the Committees on Research and Publications as provided in Chap. 5, Arts. 5 and 8.

Art. 4. The Council shall, at such time as they may fix, ask all Committees to submit estimates of their needs for the ensuing fiscal year which, together with the report of receipts and expenditures by the Committee on Finance, shall be made the basis for the annual budget to be submitted by the Council to the Society for its approval at the General Meeting in April or November.

Art. 5. The Council shall have power to take action for the Society in legal matters, to manage its affairs, and to assume its administration, to make contracts or to authorize them to be made in the name of the Society, except as otherwise provided.

Art. 6. The Council shall require reports to be presented to it at least once a year by such officers, committees, and employees of the Society as they may designate, or as may be required by the Laws to present such reports, and shall, through the President, present an annual report to the Society on the state of its affairs.

Art. 7. The Council shall have power to appoint an administrative executive officer, and to fix his term of service, duties and compensation.

Chapter V

Of the Committees of the Society

Art. 1. There shall be four Committees on Membership, one in each class, each composed of five members whose appointment and duties are prescribed in Chap. I, Arts. 4–8.

Art. 2. There shall be a Committee on Finance, consisting of the President and Treasurer, ex-officio, and not fewer than five other members who shall be nominated by the President and elected by the Society at the General Meeting in April. A majority of the Committee shall constitute a quorum at any meeting. The Committee shall keep a record of all its acts and proceedings, which shall be communicated to the Council.

Art. 3. The Committee on Finance shall have the general superintendence of the financial concerns of the Society. It shall have the custody and control of all the securities and investments of the Society, both real and personal, with full power and authority to buy and to sell, and to invest and reinvest the same; including the power to purchase and to sell real estate and to make leases thereof, to satisfy mortgages and extinguish ground rents, and to direct the placing of all such insurances as it may deem necessary; as well as to borrow on the credit of the assets of the Society, to create mortgages thereon, and to make such improvements, repairs and alterations to real estate as it may deem necessary. It shall have power to authorize the proper Officers of the Society to execute the necessary papers to effect all purchases, sales and assignments of property, both real and personal; to execute and to satisfy mortgages, to extinguish ground rents and to transfer registered securities; to subscribe to bond-holders' agreements to plans of reorganization involving any securities held by the Society or in which it has an interest, and to do all such acts as are necessary in pursuance of the foregoing powers.

Art. 4. The Committee on Finance shall always have

access to the Treasurer's books, accounts, and vouchers, and shall cause an audit of such accounts to be made at least once a year. It shall require from the Treasurer an annual report of all the operations of the treasury, which it shall present to the Council with an annual statement of estimates of receipts and expenditures. With the approval of the Council it shall determine the fiscal year of the Society and, in case of emergency needs, authorize appropriations over and above the annual budget.

ART. 5. There shall be a COMMITTEE ON RESEARCH, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years and who shall be nominated by the President and elected by the Council. A majority of the Committee shall constitute a quorum at any meeting, and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Publications, and of the Committee on Meetings, may sit with the Committee on Research but shall not vote.

ART. 6. The Committee on Research shall, with the approval of the Council, prescribe regulations for receiving and considering proposals for the advancement of knowledge through investigation. It may take such action as it shall see fit with respect to proposals received by it, and may, with the approval of the Council, itself initiate and cause to be executed investigations for the advancement of knowledge. It shall certify to the Treasurer all disbursements to be made from funds appropriated to it by the Council, and may allot therefrom such sums as it may see fit, on such conditions as it may prescribe, for the investigations approved by it. It shall require reports of the expenditures of all sums so allotted, and of the progress of all investigations aided thereby. It may withhold assistance in the event that the said reports are judged unsatisfactory.

ART. 7. The Committee on Research shall report all its acts to the Council, and from time to time submit reports

to the Society on the progress of the investigations aided by it, and on the contributions to the advancement of knowledge made by them.

Art. 8. There shall be a Committee on Publications, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years, and who shall be nominated by the President and elected by the Council. A majority of the Committee shall constitute a quorum at any meeting, and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Research and of the Committee on Meetings, may sit with the Committee on Publications but shall not vote.

Art. 9. The Committee on Publications shall supervise the contents, editing, printing, publication, distribution, and sale of all publications issued by the Society or in its name. It shall have power to employ necessary editorial assistance, and, with the approval of the Council, to appoint an Editor and to determine his duties and fix his compensation. It shall cause the necessary contracts for the manufacture of the Society's publications to be drawn up and executed. It shall certify to the Treasurer all bills which it shall have examined and approved for expenses attending the publications, as well as all disbursements to be made from funds appropriated to the Committee by the Council.

Art. 10. The Committee on Publications shall, with the approval of the Council, prescribe regulations for receiving and considering proposals for publication, and may take such action as it shall see fit with respect to proposals so received, including the allotment of funds appropriated to the Committee by the Council. The Committee shall have power to appoint referees or special sub-committees to assist it in the examination of material presented to it for publication and, in its discretion, to give honoraria for services so rendered. It shall report all its acts to the Council.

Art. 11. There shall be a Committee on Meetings, consisting of the President, ex-officio, and of not fewer than four other members representative of the four classes. The Committee shall be appointed by the President and shall have power to add to its numbers. A majority of the Committee shall constitute a quorum at any meeting and shall be requisite for any vote disposing of funds that may be allotted to the Committee. The Chairman, or a member designated by the Chairman, of the Committee on Research and of the Committee on Publications, may sit with the Committee on Meetings but shall not vote.

Art. 12. The Committee on Meetings shall be charged with the preparation of the scientific and scholarly programs of all meetings of the Society, and of all meetings held under its auspices, and with the organization of discussions, symposia, and conferences. It shall have power to name special sub-committees to assist it, and to invite suitable persons, whether members of the Society or not, to participate in such programs, discussions, symposia, etc. The Committee shall have power to use such funds as may be appropriated to it by the Council for defraying the expenses of the programs, discussions, etc., organized by it, and shall certify to the Treasurer all disbursements to be made from such funds.

Art. 13. The Committee on Meetings shall transmit to the Committee on Publications all papers, communications, reports, and other materials which it may recommend for publication.

Art. 14. There shall be a Committee on Library, consisting of the President, ex-officio, and of not fewer than six other members, representative of the four classes, who shall serve for three years and who shall be appointed by the President.

Art. 15. The Committee on Library shall supervise the administration of the Library, and shall, with the approval of the Council, prescribe regulations for its government and use. The Committee shall have power, with the ap-

proval of the Council, to employ a Librarian, determine his duties, and fix his compensation. It shall have charge of the exchange of publications, and shall have power to expend income of trust funds established specifically for purposes of the Library. The Committee shall prepare estimates of expenditures for the maintenance and increase of the Library, and shall certify to the Treasurer all bills properly payable and all disbursements to be made from funds appropriated by the Council for the purposes of the Library.

ART. 16. There shall be a COMMITTEE ON HALL, consisting of the President and Curator, ex-officio, and such other members as may be appointed by the President. They shall serve for three years and shall have charge of the Hall of the Society and of its furniture and fixtures and shall direct all necessary repairs.

ART. 17. There shall be a COMMITTEE ON NOMINATION OF OFFICERS consisting of five members,—a Chairman, appointed by the President, and the four Councillors who are entering the third year of their term of service.

ART. 18. The Committee shall, not later than December first, invite all members of the Society to submit to it informal suggestions for nominations to all offices to be filled by election at the next General Meeting.

ART. 19. The Committee shall then communicate to all members of the Society, not later than February first, a report presenting one nomination to each office to be filled by election at the next General Meeting. Nominations may also be made by petition if signed by twenty or more members and submitted to the Chairman not later than March first. Notice of such nomination must be sent to all members by April first.

ART. 20. The Committee shall prepare for use in the elections at the General Meeting a ballot in which shall be included, under each position to be filled by election, the name of the Committee's nominee, and the names, in alphabetical order, of any nominees included in petitions duly received in accordance with the Laws.

Chapter VI

On the Meetings of the Society

Art. 1. The Annual General Meeting shall be held in the month of April on days designated by vote of the Council, adopted at least three months before the date fixed therefor, at which it shall be lawful to transact all business not in contravention of the Laws.

Art. 2. The Autumn General Meeting shall be held on days designated by vote of the Council, usually in the month of November, at which it shall be lawful to transact all business not in contravention of the Laws.

Art. 3. Special meetings may be called at any time by order of the President, or, in his absence or disability, by order of a Vice-president, or by vote of the Council, for the consideration of matters of scientific or scholarly interest or for the transaction of such business as shall be specified in the order or vote calling the meeting.

Chapter VII

Of the Publications of the Society

Art. 1. The publications of the Society shall consist of Proceedings, Transactions, Memoirs, Year Book, and of such other serial or separate publications as may be authorized by the Council upon recommendation by the Committee on Publications.

Art. 2. The Proceedings shall contain papers that are read before the Society at its meetings and that have been approved by the Committee on Publications. Other papers from whatever source may also be published in the Proceedings if approved by this Committee. The Proceedings will be distributed without charge, as issued, to the members who request it.

Art. 3. The Transactions shall consist of contributions in the form of monographs, treatises, collections of documents, and other materials, approved by the Committee on Publications. The Transactions shall be issued in complete parts, one or more of which may constitute a volume.

They may be supplied to any member on such conditions or terms as may be prescribed by the Committee on Publications.

Art. 4. The Memoirs shall consist of works approved by the Committee on Publications. They shall be issued in such form as shall make possible their assembly in volumes according to subject matter, or to fields of knowledge. They may be supplied to any member on such conditions or terms as may be prescribed by the Committee on Publications.

Art. 5. The Year Book shall contain, among other items, the Charter and Laws, list of Officers and Committees, the annual report of the President and Officers, important acts of the Society and Council, reports of all standing Committees, a catalogue of prizes, premiums and lectureships, lists of all members together with those elected and those deceased during the year, and obituaries of deceased members. It shall be published as soon as possible after the close of each calendar year and shall be sent gratis to all members of the Society.

Chapter VIII

Of the Laws of the Society and their Amendment

Art. 1. No amendment or supplement to these laws, nor any new law shall be made or passed by the Society, unless the same has been duly proposed in writing at a Stated Meeting of the Society and enacted at the subsequent General Meeting; due notice of the proposed law or amendment having been sent by mail at least fourteen days before the said General Meeting to the members qualified to vote thereon.

Art. 2. At the General Meeting no amendment or supplement to these laws shall be made, nor shall any new law be made, unless there be present a quorum of at least twenty members, of whom not fewer than five shall be members of the Council, and the same be voted by two-thirds of the whole body present.

III

OFFICERS AND STANDING COMMITTEES

1940–1941

OFFICERS

PATRON

THE GOVERNOR OF PENNSYLVANIA

PRESIDENT

ROLAND S. MORRIS

VICE-PRESIDENTS

EDWIN G. CONKLIN ROBERT A. MILLIKAN WILLIAM E. LINGELBACH

SECRETARIES

JOHN A. MILLER W. F. G. SWANN

CURATOR

ALBERT P. BRUBAKER

TREASURER

FIDELITY-PHILADELPHIA TRUST COMPANY

EXECUTIVE OFFICER

EDWIN G. CONKLIN

COUNCILLORS

Elected in 1938	Elected in 1939	Elected in 1940
WILLIAM F. ALBRIGHT	ALBERT F. BLAKESLEE	DETLEV W. BRONK
ARTHUR L. DAY	WALDO G. LELAND	NATHAN HAYWARD
FRANK A. FETTER	HAROLD G. MOULTON	FREDERICK P. KEPPEL
HAROLD C. UREY	W. F. G. SWANN	HARLOW SHAPLEY

CALENDAR FOR 1940–1941

STATED MEETINGS OF THE SOCIETY

1940

November 22–23. Autumn General Meeting.

November 22, 10 A.M.–1 P.M., 2–4 P.M. Open Sessions for Reading of Papers and Reports on Researches Aided by Grants.

4 P.M. Stated Meeting of Council.

8:30 P.M. Public Lecture followed by Reception.

November 23, 10 A.M. Executive Session [1]—Summary of Important Results of Researches Aided by the Society's Grants since 1933.

Report of the Council on the Recommendations of the Committee on Publications.

Report of the Committee on Education and Participation in Science.

1941

February 14–15. Midwinter Meeting.

February 14, 10 A.M.–1 P.M., 2–4 P.M. Centennial Celebration of the Establishment of the Magnetic Observatory of Alexander Dallas Bache at Girard College and of the American Philosophical Society's Cooperation in the Initiation of a Plan Involving International Cooperation in the Study of Terrestrial Magnetism.

February 15, 10 A.M.–12 M. Papers on Various Aspects of Terrestrial Magnetism and the History of its Development.

1 P.M. Luncheon for members and invited guests at Girard College.

2–4 P.M. Addresses at Girard College.

April 23, 3 P.M. Annual Meeting of Council.

April 24–26. Annual General Meeting.

April 24, 10 A.M.–1 P.M., 2–4 P.M. Open Sessions for Reading of Papers.

9 P.M. Round Table Parties for Various Groups. (Light Refreshments.)

April 25, 10 A.M. Executive Session and Annual Election.

2 P.M. Open Session for Reading of Papers.

8.30 P.M. Penrose Memorial Lecture followed by Reception.

April 26, 10 A.M. Open Session for Reading of Papers.

2 P.M. Excursion.

7.30 P.M. The Annual Dinner.

[1] Postponed to 2 P.M. An Open Session was held at 10 A.M.

IV

MINUTES OF THE EXECUTIVE SESSIONS

1. MIDWINTER MEETING, FEBRUARY 23, 24, 1940

The Midwinter Meeting was held in commemoration of the one hundredth anniversary of the Wilkes Exploring Expedition of the United States Navy, 1838–1842.

Thirty-one members and about one hundred guests attended this meeting and nineteen papers were read.[1]

Harley H. Bartlett, recently elected member, subscribed the Laws and was admitted into the Society.

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2. ANNUAL GENERAL MEETING, APRIL 18, 19, 20, 1940

One hundred and forty members and about one hundred and fifty guests attended the meeting and thirty papers were read.[2]

The following recently elected members subscribed the Laws and were admitted into the Society during the course of the meeting: Max Farrand, William Mansfield Clark, William de Berniere MacNider, David Hilt Tennent, Linus Carl Pauling, Alfred Henry Sturtevant, Edmund Ware Sinnott, Philip C. Jessup, Joseph Henry Willits, Herbert Funk Goodrich, Harry Bateman, Nathan Hayward, Peyton Rous, John Hasbrouck Van Vleck, Arthur Hobson Quinn, Karl T. Compton, Charles Rufus Morey, Harold Glenn Moulton and Charles August Kraus. Arthur Byron Coble, a recently elected member, subscribed the Laws but was not formally admitted into the Society. Martin P. Nilsson,[3] of Lund, Sweden, signed the Laws on March 12, but was not formally admitted.

Friday, April 19, 9 A.M.

EXECUTIVE SESSION

Roland S. Morris, President, in the Chair

President Morris presented his annual report and gave a brief summary of the financial situation of the Society. He also pre-

[1] See p. 42.
[2] See p. 45.
[3] See p. 52.

sented the report of the Committee on Finance with a summary of the Treasurer's Annual Report which was on motion approved.

The Minutes of the Council Meeting held on April 18 were presented and approved.

President Morris stated that he had appointed, with the approval of Council, the three following committees for the awarding of the Society's prizes.[1]

The Henry M. Phillips Prize
Roland S. Morris, *Chairman*
George Wharton Pepper
Edward S. Corwin

The Magellanic Prize
Roland S. Morris, *Chairman*
Lyman J. Briggs
Vannevar Bush
Harlow Shapley

The John F. Lewis Prize
Edwin G. Conklin, *Chairman*
Gilbert Chinard
Detlev W. Bronk

The John F. Lewis Prize

The Council's recommendation was unanimously approved that the John F. Lewis Prize for 1940 be awarded to Earle Radcliffe Caley of Princeton University for his paper on

> "The Composition of Ancient Greek Bronze Coins" (Read in part November 27, 1937. MEM. Amer. Philos. Soc. XI: 203 pp.).

President Morris informed the Society that Jacob R. Schramm had been elected by Council to serve as Chairman of the Committee on Publications to fill the vacancy caused by the death of Cyrus Adler. He further stated that Edmund W. Sinnott had been elected a member of the Committee on Research in place of Arthur F. Buddington, whose term expired, and that John Story Jenks had been appointed Chairman of the Committee on Hall to succeed J. Bertram Lippincott, deceased.

The following recommendations for extra appropriations favorably recommended by Council were on motion approved:

The Committee on Publications' recommendation that $2,000 be appropriated for the use of the Committee in paying four

[1] See p. 329.

consultants for their services in examining manuscripts submitted, $500 to be paid to each consultant. (Rescinded, see p. 40.)

The Committee on Meetings' recommendation that a sum not to exceed $2,500 be used in connection with the Bicentennial Celebration of the University of Pennsylvania, it having been suggested that a special meeting under the auspices of the Society be held in Independence Square.[1]

The Committee on Finance's recommendation that a sum not to exceed $500 be appropriated for the entertainment in Philadelphia on May 20 of the foreign delegates to the Eighth American Scientific Congress, May 10–18.[2]

The following Committee on Finance was nominated by the President and elected for the year 1940–41:

Marshall S. Morgan, *Chairman*,
Thomas S. Gates,
Edward Hopkinson, Jr.
John S. Jenks,
Roland S. Morris,
George W. Norris,[3]
Charles J. Rhoads,
J. Henry Scattergood.

The Committee on Finance was appointed to serve as the Society's Committee on Building Fund.

The President requested those present to stand while the names of the members[4] who had died since the last meeting were read by the Secretary.

President Morris informed the Society that an additional appropriation of $8,500 had been made by the Carnegie Corporation for the expenses of the survey now being conducted in amateur science in the Philadelphia area, and stated that a report on the activities of the Committee on Education and Participation in Science would be found in the YEAR BOOK.[5]

Dr. Conklin, Chairman of the Committee on Research, gave an account of the work of the Committee during the year and stated that a complete account of the Committee's activities together with the reports from recipients of grants would be found in the YEAR BOOK,[6] reprints of which are now available.

[1] See p. 52.
[2] See p. 51.
[3] Resigned, see p. 41.
[4] See p. 405.
[5] YEAR BOOK, Amer. Philos. Soc. for 1939: 353–364.
[6] YEAR BOOK, Amer. Philos. Soc. for 1939: 147–326.

Dr. Conklin, on behalf of the Committee on Publications, presented its report and stated that the proposition to divide the PROCEEDINGS into two, three or four series was being considered.[1] He felt it was undesirable to undertake to convert this Society into a series of special societies with special journals, and that the PROCEEDINGS ought to represent in general the real proceedings of the Society.

Dr. Sioussat, Chairman of the Committee on Library, stated that a complete account of the Library's activities during the year 1939 would be found in the YEAR BOOK,[2] reprints of which are now available. Dr. Sioussat stated that one amusing matter came out of the desire to be more definite as to exactly what are the Library's holdings. It appeared that over a number of years the Library had been taking the statistics of the year before and then adding on to that the accessions of the year, thus starting in with a new total. In order to get an accurate census it was found necessary to make a shelf count of the books and a complete account is given in the 1939 Report.

Dr. Farrand, Chairman of the Special Committee to study the relation of the Library of the American Philosophical Society to other libraries in Philadelphia and also the future policy of the library administration, presented his report as follows:

The Special Committee to study the relations of the Library of the American Philosophical Society to other libraries in Philadelphia and also the future policy of the Library administration wishes to present a report of progress.

To the two original members, St. George L. Sioussat and the Chairman, have been added Harry M. Lydenberg, Director of the New York Public Library, and Harlow Shapley, Director of the Harvard College Observatory.

The problem is being carefully studied but it is impossible to reach conclusions without having further data upon the extent of duplication with other libraries. The compilation of these data is now in process and when completed the Committee hopes to be able to make definite recommendations, some of which promise to be far reaching.

The Committee accordingly asks to be continued for another year but expects to make its report before the expiration of that period.

Max Farrand, *Chairman.*

April 3, 1940.

[1] See p. 78.

[2] YEAR BOOK, Amer. Philos. Soc. for 1939: 108–135.

The Council has granted the request for a continuation of the Committee for another year.

Dr. Thomas S. Gates, Chairman of the Committee on Nomination of Officers consisting of the retiring Councillors, Edward Capps, Luther P. Eisenhart, Alfred N. Richards and John M. Scott, gave an account of the work of the Committee, and stated that it was unanimous in hoping that Mr. Morris would consent to act as President for another year. He stated that Mr. Morris was reluctant to do this, and protested that he felt the Society should at an appropriate time make a change, but the Committee was eager and hopeful that he would continue to carry on the splendid and outstanding work that has been accomplished under his administration, and he finally agreed that his name might be placed in nomination for the coming year. The Committee has very great pleasure and a very great sense of obligation to Mr. Morris for having been willing to thus carry on this work, which in many parts is still to be completed—the work to which he has given his vital interests.

President Morris stated that there is nothing that has given him more pleasure than the opportunity to preside over this Society, but that he felt it desirable that the term of service of the President should be limited to not more than ten years.

The ballot as prepared by the Committee on Nomination of Officers was unanimously approved.

Annual Election

The Society proceeded to the election of officers and members. St. George L. Sioussat and Waldo G. Leland acted as Judges and John S. Jenks as Clerk of election.

The tellers subsequently reported that the following officers and members had been duly elected:

OFFICERS

President

Roland S. Morris

Vice-Presidents

Edwin G. Conklin
Robert A. Millikan
William E. Lingelbach

Secretaries

John A. Miller
W. F. G. Swann

Curator

Albert P. Brubaker

Treasurer

Fidelity-Philadelphia Trust Company

Councillors

(To serve for three years)

Harlow Shapley, *Class I*
Detlev W. Bronk, *Class II*
Nathan Hayward, *Class III*
Frederick P. Keppel, *Class IV*

MEMBERS

CLASS I—MATHEMATICAL AND PHYSICAL SCIENCES

Resident

Ira Sprague Bowen, Pasadena, Calif.
William Francis Giauque, Berkeley, Calif.
Jerome Clarke Hunsaker, Boston, Mass.
George Bogdan Kistiakowsky, Cambridge, Mass.
Robert Sanderson Mulliken, Chicago, Ill.
Howard Percy Robertson, Princeton, N. J.
John Clarke Slater, Cambridge, Mass.

Foreign

Niels Henrik David Bohr, Copenhagen, Denmark
Sir William Henry Bragg, London, England
Tullio Levi-Civita, Rome, Italy

CLASS II—GEOLOGICAL AND BIOLOGICAL SCIENCES

Resident

George Washington Corner, Baltimore, Md.
Samuel Randall Detwiler, New York, N. Y.
Eugene Floyd DuBois, New York, N. Y.
Frederick Lee Hisaw, Cambridge, Mass.

Esmond Ray Long, Philadelphia, Pa.
Elvin Charles Stakman, St. Paul, Minn.
Wendell Meredith Stanley, Princeton, N. J.

Foreign

Pierre Janet, Paris, France

CLASS III—SOCIAL SCIENCES

Resident

Hamilton Fish Armstrong, New York, N. Y.
Joseph Perkins Chamberlain, New York, N. Y.
John Dickinson, Philadelphia, Pa.
Carlton Joseph Huntley Hayes, New York, N. Y.
William Fielding Ogburn, Chicago, Ill.
Roscoe Pound, Watertown, Mass.
Adolph G. Rosengarten, St. Davids, Pa.

Foreign

Eli Filip Heckscher, Stockholm, Sweden
Lord Stamp, Shortlands, Kent, England

CLASS IV—HUMANITIES

Resident

Joseph Quincy Adams, Washington, D. C.
Charles Henry Beeson, Chicago, Ill.
Charles Burton Gulick, Cambridge, Mass.
Frank Jewett Mather, Jr., Washington Crossing, Pa.
Sylvanus Griswold Morley, Merida, Yucatan, Mexico
Arthur Hobson Quinn, Bala-Cynwyd, Pa.
George Andrew Reisner, Boston, Mass.

Foreign

Franz Valery Marie Cumont, Rome, Italy
Ramón Menéndez Pidal, Madrid, Spain

COUNCIL NOMINEES

Morris Duane, Rosemont, Pa.
Morris E. Leeds, Philadelphia, Pa.

The portrait of Elihu Thomson was presented, and a vote of thanks and appreciation was extended to Mrs. Thomson for this

very striking portrait of Professor Thomson, who was, at the time of his death in 1937, the oldest member in length of service. He was elected to the Society in 1876.

3. AUTUMN GENERAL MEETING, NOVEMBER 22, 23, 1940

Seventy-five members and about one hundred guests attended the meeting and twenty-two papers were read.[1]

The following recently elected members subscribed the Laws and were admitted into the Society: H. P. Robertson, Charles Burton Gulick, George W. Corner, T. Leslie Shear, Adolph G. Rosengarten, Morris E. Leeds, Esmond Ray Long, John Dickinson, Wendell M. Stanley, and Carlton J. H. Hayes.

The Friday Evening Lecture was given by Edward S. Corwin, Professor of Jurisprudence, Princeton University; after the lecture Dr. Conklin presented to him a Franklin Medal and gave a short description of the Medal which was struck by the United States Mint in 1906 in commemoration of the two hundredth anniversary of the birth of Benjamin Franklin.

Saturday, November 23, 2:30 P.M.

EXECUTIVE SESSION

Roland S. Morris, President, in the Chair

Copies of the Treasurer's Report were circulated and President Morris submitted the budget for 1941 which was on motion approved.

The Committee on Publications' request that the Society reconsider its action of April 19, 1940,[2] regarding the appropriation of $2,000 for the Committee to pay four consultants for their services in examining manuscripts, was considered and the Committee's request that this sum be made available for general editorial supervision and the examination of manuscripts was approved and the previous action was rescinded.

The Council's recommendation was approved that an extra appropriation of $15,000 be made for the use of the Committee on Research for the remainder of the year 1940.

[1] See p. 49.
[2] See p. 35.

The Committee on Meetings' suggestion that admission to the luncheons during the Midwinter, Annual and Autumn Meetings of the Society should be by ticket and that each member be entitled to two tickets and that extra tickets be purchased was carefully considered. The following recommendation was approved:

> *Resolved*, that hereafter tickets of admission be issued and that each member be allowed one or two tickets as may be requested and that additional tickets be purchased.

President Morris announced the donation by Mr. William Guggenheim, New York, of a set of twelve Pennsylvania Bicentennial Wedgwood dinner plates, commemorating the two hundredth anniversary of the founding of the University of Pennsylvania.

The names of the members [1] who had died since the last meeting were read, while the members present stood as a mark of respect.

On behalf of the Committee on Education and Participation in Science, Mr. W. Stephen Thomas, Executive Secretary, presented a report [2] of the Executive Staff's activities during the past year.

Dr. Frederick P. Keppel, President of the Carnegie Corporation of New York, expressed to the Society the Carnegie Corporation's appreciation for its sponsoring of this work.

Dr. Conklin, Chairman of the Committee on Research, presented a summary of the grants awarded since July 1933 to date and stated that four hundred and eighty-five grants had been made totalling $446,881, and that $12,811 had been returned as refunds and cancellations. Each member of the Committee on Research reported to the Society his estimate of the value of the researches in the fields with which he was familiar.[3]

It was recommended that the Report of the Committee on Publications be postponed until the Annual Meeting, 1941.

A letter was read from George W. Norris offering his resignation as a member of the Committee on Finance owing to ill health. Mr. Norris' resignation was accepted.

A letter was received from the Warden of Christ Church in Philadelphia thanking the Society for purchasing a bench to be used in the Garden at Christ Church Grave Yard; the name of the Society is inscribed on the bench.

[1] See p. 405.
[2] See p. 319.
[3] See p. 103.

V

REPORTS OF STANDING COMMITTEES

1. REPORT OF THE COMMITTEE ON MEETINGS

The Committee on Meetings for the year 1939–40 was reappointed to serve during 1940–41. The Committee consisted of Roland S. Morris, *President*, Edwin G. Conklin, *Chairman*, Frank Aydelotte, Karl K. Darrow, Merkel H. Jacobs, Horace H. F. Jayne, Waldo G. Leland, Phoebus A. Levene, William E. Lingelbach, John A. Miller and David H. Tennent.† Dr. Levene died on September 6, 1940, but no one was appointed to fill the vacancy caused by his death.

The Committee held four meetings during the year, namely, on March 13, May 6, October 23 and November 22 and programs for future meetings were discussed and symposia and speakers proposed. Special thanks are due to Professor William H. Hobbs, University of Michigan, for his valuable services in organizing the program for the Midwinter Meeting on the Wilkes Exploring Expedition and on American Polar Exploration, and also to Dr. Frederick P. Keppel, Carnegie Corporation of New York, for organizing and conducting the Symposium on Characteristics of American Culture which was given in connection with the Annual General Meeting on April 19, 1940.

REGULAR MEETINGS OF THE SOCIETY

MIDWINTER MEETING, FEBRUARY 23, 24, 1940

CENTENARY CELEBRATION OF THE WILKES EXPLORING EXPEDITION OF THE UNITED STATES NAVY, 1838–1842, AND SYMPOSIUM ON AMERICAN POLAR EXPLORATION[1]

The Exploring Expedition of the United States Navy (1838–1842) under Commander Charles Wilkes was the most extensive

† Deceased January 14, 1941.

[1] Published in full in Proc. Amer. Philos. Soc. 82, No. 5: 519–947.

and in many regards the most important scientific expedition ever sponsored by the United States Government. It followed by only two years the voyage of H. M. S. *Beagle*, made famous by Charles Darwin, and in addition to notable discoveries in geology and oceanography, botany, zoology, anthropology and ethnology, it is most widely known for Dana's study of the formation of coral islands and reefs, and for the first demonstration that Antarctica is a major continent, which fact was determined just one hundred years ago (February, 1840).

Of the eighteen papers presented in this symposium, thirteen treat of the Wilkes Expedition and Antarctic Exploration and five of American Arctic Exploration.

Friday, February 23, 10 A.M.

Roland S. Morris, President, in the Chair

The following papers were read by the persons named:

THE WILKES EXPEDITION

Edwin G. Conklin, Vice-president and Executive Officer, American Philosophical Society, and James A. G. Rehn, Corresponding Secretary, Academy of Natural Sciences of Philadelphia. "Connection of the American Philosophical Society and the Academy of Natural Sciences of Philadelphia with Our First National Exploring Expedition."

Captain G. S. Bryan, Hydrographic Office, United States Navy. "The Purpose, Equipment and Personnel of the Wilkes Expedition."

William H. Hobbs, Professor Emeritus of Geology, University of Michigan. "The Discovery of Wilkes Land, Antarctica."

Commander F. W. Reichelderfer, Chief, United States Weather Bureau. "The Contributions of Wilkes to Terrestrial Magnetism, Gravity and Meteorology."

Harley H. Bartlett, Chairman, Department of Botany, Director, Botanical Garden, University of Michigan. "The Expedition Reports and the Work of the Specialists in Science."

Mary E. Cooley, Instructor in Geology and Geography, Mount Holyoke College. "The Exploring Expedition in the Pacific."

Friday, February 23, 2 P.M.

William H. Hobbs, Professor Emeritus of Geology, University of Michigan, in the Chair

AMERICA IN THE ANTARCTIC

Colonel Lawrence Martin, Chief, Division of Maps, Library of Congress. "The First Discovery of Antarctic Land by Captain Nathaniel Brown Palmer of Stonington, Connecticut."

John E. Hoffmeister, Professor of Geology, University of Rochester. "James Dwight Dana's Studies of Volcanoes and of Coral Islands."

Henry W. Fowler, Curator of Fishes, Academy of Natural Sciences of Philadelphia. "The Fishes Obtained by the Wilkes Expedition."

Captain Harold E. Saunders, Construction Corps, United States Navy. "The Flight of Admiral Byrd to the South Pole and the Exploration of Marie Byrd Land."

W. L. G. Joerg, Chief, Division of Maps and Charts, The National Archives. "Demonstration of the Peninsular Nature of Palmer Land, Antarctica, Through Ellsworth's Flight of 1935."

Earle B. Perkins, Zoologist of the Second Byrd Antarctic Expedition; Assistant Professor of Zoology, Rutgers University "Animal Life of the Antarctic." (Illustrated with moving pictures.)

Friday, February 23, 8:15 P.M.

EVENING LECTURE

Laurence M. Gould, Senior Scientist and Second-in-Command, First Byrd Antarctic Expedition, and Professor of Geology, Carleton College. "Glaciers of the Antarctic."

The lecture was followed by a reception.

Saturday, February 24, 10 A.M.

Isaiah Bowman, President, Johns Hopkins University, in the Chair

AMERICA IN THE ARCTIC

W. Elmer Ekblaw, Scientist of MacMillan's Four-Year Arctic Expedition; Professor of Geography, Clark University. "The Arctic Voyages and Discoveries of DeHaven, Kane and Hall."

Commander Edward Ellsberg, United States Naval Reserve, Author of the *Saga of the Jeannette*. "The Drift of the *Jeannette* in the Arctic Sea."

Vilhjalmur Stefansson, Arctic Explorer; Past President of the Explorers Club. "New Lands and Seas Discovered by Stefansson's Arctic Expeditions."

Hugh J. Lee, Peary's Companion on the Crossing of Greenland, 1895. "Peary's Transections of North Greenland, 1892–95."

Captain Robert A. Bartlett, Lieutenant Commander, United States Naval Reserve, Commander of the Arctic Ship *Roosevelt* and Peary's Principal Assistant. "Peary's Extended Exploration of Arctic Lands Culminating in the Attainment of the North Pole."

ANNUAL GENERAL MEETING, APRIL 18, 19, 20, 1940

Thursday, April 18, 10 A.M.

Robert A. Millikan, Vice-president, in the Chair

The following papers were read by the persons named:

Cecilia Payne-Gaposchkin and Fred L. Whipple, Harvard College Observatory. "Theoretical Synthesis of Supernova Spectra."

Philip Taylor and R. Stanley Alexander, Assistants at the Flower Observatory, University of Pennsylvania. (Introduced by Dr. Olivier.) "A Detailed Visual and Photographic Study of Certain Eclipsing Variable Stars."

Karl Kelchner Darrow, Research Physicist, Bell Telephone Laboratories. "The Ionosphere."

Dorothy Wrinch, Rockefeller Fellow and Fellow of Somerville College, Oxford, England; Member of the Chemical Faculty, Johns Hopkins University. (Introduced by Dr. Davenport.) "Atomic Patterns and Living Matter."

William B. Scott,* Professor Emeritus of Geology, Princeton University. "Presentation of Parts III and IV of Monograph on White River Mammalia."

H. E. Warmke and A. F. Blakeslee, Investigators, Department of Genetics, Carnegie Institution of Washington. "Induced Self Fertility in a Dioecious Species by Changing the Proportion of X and Y Sex Chromosomes."

G. H. Parker, Professor Emeritus of Zoology, Harvard University. "The Activating Substances in the Color Changes of the Common Catfish."

* Recipient of Grant from the Penrose Fund.

Edward Girden,* Instructor in Psychology, Brooklyn College. "The Dissociative Effects of Curare."

Thursday, April 18, 2 P.M.

Edwin G. Conklin, Vice-president, in the Chair

The following papers were read by the persons named:

George Crile and Daniel P. Quiring, Cleveland Clinic Foundation and Western Reserve University. "The Influence of Habitat Temperature on the Size of the Brain, Thyroid Gland and Heart."

Gilbert Chinard, Professor of French Literature, Princeton University. "The 'Mission' of André Michaux and his Western Trip."

Kenneth N. McKee,* Instructor in French, New York University. (Introduced by Dr. Lingelbach.) "The Popularity of the 'American' on the French Stage During the Revolution."

M. B. Emeneau,* Research Fellow, Yale University. (Introduced by Dr. Edgerton.) "A Classical Indian Folktale as a Reported Modern Event: The Brahman and the Mongoose."

Leicester B. Holland, Chief, Division of Fine Arts, Library of Congress. "Pompholyges and Ochetoi, a Technological Interpretation of Greek Technical Terms."

Earle R. Caley, Assistant Professor of Chemistry, Princeton University. (Introduced by Dr. Meritt.) "A Method for Enhancing the Durability of Paper Squeezes."

Henry A. Sanders, Professor Emeritus of Latin, University of Michigan. "Abbreviation Signs for *Centuria* and *Turma*."

Alexander Goetz, Associate Professor of Physics, California Institute of Technology. (Introduced by Dr. Millikan.) "An Extremely Sensitive Biophysical Indicator for Metal Ions."

Thursday, April 18, 8:15 P.M.

Henry Norris Russell, in the Chair

EVENING LECTURE

Dayton C. Miller, Honorary Professor of Physics, Acting Head of the Department, Case School of Applied Science. "The Pipes of Pan, Old and New." (Accompanied by demonstrations.)

The lecture was followed by a reception.

Friday, April 19, 9 A.M.

EXECUTIVE SESSION [1]

Friday, April 19, 10:30 A.M.

SYMPOSIUM ON CHARACTERISTICS OF AMERICAN CULTURE AND ITS PLACE IN GENERAL CULTURE [2]

Frederick P. Keppel, in the Chair

The following papers were read by the persons named:

Frederick L. Allen, Associate Editor, *Harper's Magazine.* "Today."

Alfred V. Kidder, Chairman, Division of Historical Research, Carnegie Institution of Washington. "Looking Backward."

Lewis Mumford, Author. "Looking Forward."

An open discussion was led by Van Wyck Brooks, Author and Literary Historian, Westport, Connecticut, and the following members took part: Messrs. H. S. Morris, Mees, Huntington, Swann, and Russell; and F. L. Allen and Mumford, guests.

Friday, April 19, 2 P.M.

Frederick P. Keppel in the Chair

The following papers were read by the persons named:

Francis H. Taylor, Director, Metropolitan Museum of Art. "The Fine Arts."

Otto Luening, Professor and Chairman, Department of Music, Bennington College. "Music."

Arthur H. Compton, Professor of Physics, University of Chicago. "Science."

Further discussion was led by Van Wyck Brooks, and the following members took part: Messrs. Chinard, A. H. Compton, Mees, Huntington.

Friday, April 19, 8:15 P.M.

Roland S. Morris, President, in the Chair

THE R. A. F. PENROSE, JR., MEMORIAL LECTURE

Archibald MacLeish, Librarian of Congress: "Writers and Scholars."

The lecture was followed by a reception.

[1] See p. 33.

[2] Published in Proc. Amer. Philos. Soc. 83, No. 4: 515–588.

Saturday, April 20, 10 A.M.

Roland S. Morris, President, in the Chair

The following papers were read by the persons named:

Herbert Shapiro, Instructor in Physiology, Vassar College, and Gregory Pincus,* Visiting Professor of Biology, Clark University. (Introduced by Dr. Conklin.) "The Parthenogenetic Activation of Rabbit Eggs *in vitro* and *in vivo*."

James H. Gaul,* Fellow, American School of Prehistoric Research. (Introduced by Dr. MacCurdy.) "Observations on the Neolithic Period in the East Balkan Peninsula."

Herbert E. Winlock, Director Emeritus, Metropolitan Museum of Art. "The Origin of the Ancient Egyptian Calendar."

William Bell Dinsmoor, Professor of Archaeology, Columbia University. "An Archaeological Earthquake at Olympia."

David M. Robinson, Professor of Archaeology and Epigraphy, Johns Hopkins University. "A New Marble Bust of Menander, Wrongly Called Vergil."

William Lyon Phelps, Professor Emeritus of English Literature, Yale University. "More Notes on Shakespeare."

Saturday, April 20, 2 P.M.

Immediately after the luncheon members and guests were taken either to the Widener Art Gallery, Elkins Park, or to the R.C.A. Laboratory in Camden to see Zworykin's Electron Microscope, and later to a reception at the home of President and Mrs. Thomas S. Gates of the University of Pennsylvania, in Chestnut Hill.

Saturday, April 20, 7:30 P.M.

The annual dinner was held at the Bellevue-Stratford Hotel, President Morris presiding.

After dinner Dr. Benjamin D. Meritt, of the Institute for Advanced Study, presented Dr. Earle Radcliffe Caley, of Princeton University, for the John F. Lewis Prize.[1] The prize, consisting of a check and a diploma, was awarded to Dr. Caley who made a brief response in accepting this honor.

The following after-dinner addresses were made:

[1] See p. 34.

A. V. Hill, Foulerton Research Professor and Secretary of the Royal Society. "The Royal Society and the American Philosophical Society."

Philip C. Jessup, Professor of International Law, Columbia University. "Neutrality Today."

Thomas S. Gates, President, University of Pennsylvania. "The Bicentenary of the University of Pennsylvania."

AUTUMN GENERAL MEETING, NOVEMBER 22, 23, 1940

Friday, November 22, 10:30 A.M.

Roland S. Morris, President, in the Chair

The following papers were read by the persons named:

H. P. Robertson, Professor of Mathematical Physics, Princeton University. "Stationary Stellar Systems." (Discussed by Dr. Shapley.)

K. Aa. Strand,* Research Associate, Sproul Observatory, Swarthmore College. "The Orbital Motion of Zeta Aquarii." (Discussed by Mrs. Gaposchkin.)

W. F. G. Swann, Director, Bartol Research Foundation of the Franklin Institute. "The Origin of the Secondary Peak in the Rossi Curve for Tin."

S. A. Korff,* Research Fellow, Bartol Research Foundation of the Franklin Institute; Research Associate, Carnegie Institution of Washington. "The Production of Neutrons by the Cosmic Radiation." (Discussed by Dr. Swann.)

Henry A. Boorse,* Assistant Professor of Physics, Columbia University (Barnard College). (Introduced by Dr. Urey.) "Some Problems of Low Temperature Physics." (Discussed by Drs. Swann, Aydelotte and Urey.)

Oswald Veblen, Professor of Mathematics, Institute for Advanced Study. "Report on *Mathematical Reviews*."

Friday, November 22, 2 P.M.

William E. Lingelbach, Vice-president, in the Chair

The following papers were read by the persons named:

Franz Boas, Professor Emeritus of Anthropology, Columbia University. "Relation Between Physical and Mental Development." (Discussed by Dr. Davenport.)

Daniel Sutherland Davidson,* Assistant Professor of Anthropology, University of Pennsylvania. "Rock Paint-

* Recipient of Grant from The Penrose Fund.

ings and Carvings in Western Australia." (Discussed by Dr. Kidder.)

Mary Butler,* Research Associate, University Museum, University of Pennsylvania. "An Archaeological Survey of the Alta Verapaz, Guatemala." (Discussed by Dr. Kidder.)

L. S. Cressman,* Professor of Anthropology, University of Oregon; John Simon Guggenheim Memorial Foundation Fellow 1940–41. "Studies on Early Man in South Central Oregon."

Edith von Porada,* Research Fellow, John Pierpont Morgan Library. "The Collection of Cylinder Seals in the Pierpont Morgan Library."

Nelson Glueck,* Professor of Bible and Biblical Archaeology, Hebrew Union College. "Ezion-geber: Solomon's Seaport." (Discussed by Dr. Albright.)

Campbell Bonner, University of Michigan, in the Chair

T. Leslie Shear, Professor of Classical Archaeology, Princeton University. "Résumé of Results of Ten Years' Excavation in the Athenian Agora." (Discussed by Dr. Meritt.)

Friday, November 22, 8:30 P.M.

Roland S. Morris, President, in the Chair

EVENING LECTURE

Edward S. Corwin, Professor of Jurisprudence, Princeton University. "Some Aspects of the Presidency." [1]

The lecture was followed by a reception.

Saturday, November 23, 10 A.M.

Edwin G. Conklin, Vice-president, in the Chair

The following papers were read by the persons named:

A. P. Coleman, Lecturer in East European Languages, Columbia University. (Introduced by Dr. Prince.) "Sir John Bowring and Slavonic Poetry." (Discussed by Dr. Conklin.)

William B. Scott,* Professor Emeritus of Geology and Paleontology, Princeton University. "The Mammalian Fauna of the White River Oligocene." (Read by title.)

Glenn L. Jepsen, Associate Professor of Geology, Princeton University. (Introduced by Dr. W. B. Scott.) "The

[1] Franklin Medal presented to Dr. Corwin, see p. 40.

Ancestry of the 'Flying Lemur.'" (Discussed by Drs. Shull and Conklin.)

William J. Robbins,* Professor of Botany, Columbia University; Director, New York Botanical Garden. "Vitamin B_6 and Growth of Excised Tomato Roots." (Discussed by Drs. Bronk and White.)

Charles B. Davenport, Director (ret.), Department of Genetics, Carnegie Institution of Washington. "Responsive Bone." (Discussed by Drs. Weiss and Corner.)

Alexander Weinstein,* Zoological Laboratory, Columbia University. "The Geometry and Mechanics of Crossing Over." (Discussed by Drs. Whiting and Conklin.)

Paul Weiss,* Associate Professor of Zoology, University of Chicago. "Autonomous vs. Reflexogenous Activity of the Central Nervous System." (Discussed by Dr. Bronk.)

Leonard G. Rowntree,§ Director, Philadelphia Institute for Medical Research. "The Work of the Philadelphia Institute for Medical Research."

Saturday, November 23, 2:30 P.M.

EXECUTIVE SESSION [1]

SPECIAL MEETINGS AND RECEPTIONS

May 20, 1:30 P.M. Luncheon for the Foreign Delegates to the Eighth American Scientific Congress.

Three hundred foreign delegates to the Eighth American Scientific Congress which met in Washington May 10–18 were entertained at luncheon in the Hall of the American Philosophical Society during their visit to Philadelphia on May 20, after which they were taken to the Academy of Natural Sciences, the Franklin Institute and the University Museum.

August 18, 7 P.M. Address by Ambassador William C. Bullitt in Independence Square.

The American Philosophical Society sponsored the address presented by William C. Bullitt, United States Ambassador to France, who had recently returned to this country. Mr. Bullitt spoke on the War in Europe and its effect on the United States.

§ Recipient of Grant from the Daland Fund.

1 See p. 40.

September 19, 9 P.M. Reception in Connection with the Bicentennial Celebration of the University of Pennsylvania.

A reception was held at nine o'clock on the evening of September 19 in the Hall of the Society and about two hundred delegates and speakers at the Bicentennial Celebration of the University of Pennsylvania attended.

MEETINGS OF OTHER ORGANIZATIONS

THE ARCHAEOLOGICAL INSTITUTE OF AMERICA

The Archaeological Institute of America, Philadelphia Society, was granted the privilege of holding its three meetings for the year 1939–40 and its five meetings for the year 1940–41 in the Hall of the American Philosophical Society. During 1940 the following lectures were presented:

January 17, 8:15 P.M. James L. Kelso, Pittsburgh-Xenia Theological Seminary. "From Factory to Kitchen in Palestine."

March 12, 8:15 P.M. Martin P. Nilsson, Professor Emeritus of Classical Archaeology and Ancient History, University of Lund. "The Value of Archaeology for Understanding the Archaic Age in Greece."

November 14, 8:15 P.M. Rhys Carpenter, Professor of Classical Archaeology, Bryn Mawr College; In Charge of the Classical School, American Academy in Rome 1939–40. "New Light on Ancient Sculpture in Rome."

December 12, 8:15 P.M. Joint Meeting with the Oriental Club of Philadelphia. William F. Albright, Professor of Semitic Languages, Johns Hopkins University. "The Archaeology of Palestine Today."

THE JAYNE MEMORIAL LECTURE

March 27, 8:15 P.M. The Jayne Memorial Lecture for 1940 was presented by Dr. Francis Randolph Packard on "The Conquest of Surgical Pain."

2. REPORT OF THE COMMITTEE ON HALL

The members of the Committee for 1940–41 are as follows: John Story Jenks, *Chairman*, Paul P. Cret, Marshall S. Morgan, Lawrence J. Morris, J. Rodman Paul,† and John M. Scott. The *ex-officio* members are Roland S. Morris, *President;* Albert P. Brubaker, *Curator;* and Edwin G. Conklin, *Executive Officer*.

The Committee calls attention to the long and devoted services of the late J. Bertram Lippincott who served as Chairman of this Committee from 1924 until his death on January 19, 1940. Mr. Jenks was appointed to succeed Mr. Lippincott as Chairman at the Annual General Meeting in April.

It has not been necessary to hold any meetings of the Committee during the year, since there were very few alterations or additions needed. The principal repairs were to the roof which involved the scraping off and removing of loose paint, patching and repainting of roof, renewing one copper eave pipe at northeast corner of roof, installing new copper rain conductor at northwest corner of building and four new copper spout-guards in the eave pipes. All woodwork on the outside of the building was painted and the hallway from the basement to the top floor was repainted. This has greatly improved the appearance of the Hall both outside and inside. Four windows, two in the executive office and two in the general office on the first floor, which had not been repaired in previous years, were put into good condition so that they are now weather proof. A large bookcase in the reception room on the second floor which was no longer needed in that place was removed, thus enlarging the room in its narrowest portion, and the portraits in that room were rearranged on the walls after the removal of the bookcase.

A notable addition to the Society's collection of portraits is one of our late honored member, Elihu Thomson, which was presented by Mrs. Thomson. This portrait has been hung in the reception room along with portraits of other distinguished scientists.

It will be necessary for the Committee on Hall in the near future to consider some remedy for the drainage of ground water from

† Deceased January 27, 1941.

Independence Square into our basement. Attention was called to this in the Report [1] of the Committee for last year and the Executive Officer has had several conferences with H. W. Murphey, Chief of the Department of Public Works, Philadelphia, regarding the drainage of Independence Square which is faulty in that all surface water from the northeast corner of the Square drains to a low spot back of the Hall of the Society. The proper remedy for this would be to regrade the walks in this portion of the Square so that there would be no low spot immediately back of the building. It is an interesting fact that this trouble with ground water is apparently a matter of long standing, since the very first reference to the present location of the Hall of the American Philosophical Society, contained in a Minute of the Society of November 18, 1785, reads:

> "Robert's account 'for proping [sic] the State house Wall [sic] and securing it against the influence of the frost, on one side of the Society's cellar, ordered to be paid; said account including plank and scantling amounting to £3··16··6.'"

To the Minute has been appended the following note:

> "This must refer to the wall running around the State House yard, a jog in which must have been made to let in the Society's building."

After some one hundred and fifty years of attempting to divert the ground water it would seem that it is time to make some radical improvement in this situation.

In the last Report of this Committee various steps in the construction of the Hall of the Society as recorded in the Minutes were outlined and brought down to the time when the Society had actually entered upon the use of its building in November 1789. It is hoped that in the future the history of the Hall following that period and down to the present time may be given in outline since there have been numerous and very interesting enterprises that have had their home in this Hall.

[1] YEAR BOOK, Amer. Philos. Soc. for 1939: 96–107.

3. REPORT OF THE COMMITTEE ON THE LIBRARY

The Committee on the Library has the honor to present the following report for the calendar year 1940.

I. Report of the Librarian

In order to facilitate the work of the Committee on Library Policy [1] the staff has spent a considerable amount of time this year in an analysis of our serial holdings which constitute slightly more than two-thirds of the 100,000 volumes in the Library. The checking, begun in June 1939, of the second edition of the *Union List of Serials* has been continued through 1940. Using this *Union List* as a basis we have compiled a checklist of our current serials, approximately 1,500 titles (exclusive of government documents), showing the duplications existing in the Academy of Natural Sciences, the Franklin Institute, the Free Library of Philadelphia, and the University of Pennsylvania. The purpose of this project is to eliminate, as far as is feasible, future unnecessary duplication, thereby releasing shelf space and funds for the acquisition of important publications not found in the Philadelphia area. In addition to the checklist, a card file of our complete serial holdings is being compiled, which also will show the duplications in the abovementioned libraries. The Committee on the Library wishes to place on record its sincere thanks to these four libraries for their helpful cooperation.

Work has been resumed on the inventory of our imprints before 1800. From this are being compiled a checklist of Americana [2] and an association file noting presentations, bookplates, autographs, marginalia, etc.

Additional Equipment Acquired.

The accommodations in the reading room have been improved by the addition of two tables, twelve walnut arm chairs and Venetian blinds. In order better to protect the more valuable folio

[1] Year Book, Amer. Philos. Soc. for 1939: 52.

[2] Each imprint is checked with Evans or Sabin; a card file is being made of all titles not found therein.

volumes formerly shelved in the open stacks, seven sections of metal bookcases equipped with locks and wire-glass doors have been installed in the committee room and adjoining office. One fifteen-drawer unit has been added to the card cabinets.

Holdings of the Library.

At the close of 1940 the total number of volumes in the Library is 100,176 (of which 69,310 are serial publications), of pamphlets 36,926, of maps 5,719. At the close of 1939 the corresponding figures were: 98,104 volumes (of which 67,782 were serials), 36,553 pamphlets, and 5,645 maps.

Additions to the Library.

During 1940 there have been added to the Library 1,972 volumes, of which 1,528 were serials; 373 pamphlets; 74 maps; 17 manuscripts (exclusive of the additions to the Elihu Thomson Papers); 16 typescripts; 11 photostats and photographs; 6 charts and posters; 4 broadsides; and 2 microfilms. Of these there have been acquired by gift or exchange 1,326 volumes, of which 1,081 were serials; 328 pamphlets; 73 maps; 6 manuscripts; 16 typescripts; 11 photostats and photographs; 6 charts and posters; and 3 broadsides.

The purchases have been on account of the following:

Funds	Purpose	Vol. (other than serials)	Pam.	Map (photo.)	Mss.	Broadside	Serial Titles	Microfilms
General ...	Unrestricted	128	44	1	11	1	124	2
Balch	International Law						2	
Boyé	Chemistry and Geology	1					2	
Carlier	Unrestricted	10					6	
Franklin ..	Unrestricted	6	1				2	
Jefferson ..	Unrestricted						1	
Magellanic .	Navigation, Astronomy, Natural Philosophy .						5	
Michaux ...	Forestry, Botany, Agriculture	1					48	
Norris	Unrestricted	11					6	
Phillips ...	Archaeology, Philology.	37					140	
Proud	Unrestricted	5					4	
Seybert ...	Unrestricted						3	
Tilghman ..	Unrestricted						4	

Donations to the Library.

During 1940 this Library has been the recipient of several generous gifts. Mrs. William P. Gest has added 107 volumes to her previous contributions from the library of her husband, a former member of the Society; Mr. Francis A. Foster of Vineyard Haven, Massachusetts, who has spent considerable time extracting from our Franklin Papers material relative to the French volunteers in the American Revolution, has presented approximately 100 volumes of the publications of the Champlain Society and the Hakluyt Society, and in addition will send future publications of the Champlain Society as issued; the Metropolitan Museum of New York by a generous gift of its publications in Egyptology, comprising ten miscellaneous pamphlets, the *Papers*, No. 1, 3 and 5, the *Publications* of the Department of Egyptian Art, Vol. 2–5, and the *Publications* of the Egyptian Expedition, Vol. 6–9, 12 and 14, has nearly completed our files of these titles. (For gifts of manuscript material see Pt. II of this Report.)

Donations have been made by the following members of the Society: Edwin G. Conklin, William B. Dinsmoor, Max Farrand, Arthur W. Goodspeed, Aleš Hrdlička, Harrison S. Morris, Roland S. Morris, Charles P. Olivier, George Wharton Pepper, A. S. W. Rosenbach, T. J. J. See, Sir Mark Aurel Stein, and Henry Osborn Taylor.

Among the many non-members who have contributed are:

Arthur B. Berthold
R. G. and G. C. Blakey
Mrs. Chester C. Bolton
Clarence S. Brigham
Jasper Yeates Brinton
Hobart C. Dickinson
H. D. Eberlein
Rudolph von Erhardt
G. M. Fitzgerald
Roscoe B. Gaither
Harrold E. Gillingham
Hyman I. Goldstein
Malcolm K. Graham
Elihu Grant
Miss M. B. Haupt
Miss Annie B. Hays
Robert C. Hoffman
Alban W. Hoopes
Miss Florence Keen
Frederic R. Kirkland
L. C. Levy
G. F. Lisanti
James M. Little
William Gwinn Mather
Lawrence Martin
Raymond Pitcairn
Bruno Roselli
Enrique Spara
C. A. Stonehill
George S. Terry
Dixon Wecter
Charles Denby Wilkes
John A. Wilson
Edwin Wolf, 2nd
George S. Wykoff

Learned societies, institutions, libraries, and universities have contributed generously. Outstanding among them are:

American Committee for International Wild Life Protection, New York.
Armour Institute of Technology, Chicago.
Buhl Foundation, Pittsburgh.
Bunrika University, Tokyo, Japan.
Cambridge Philological Society, Cambridge, England.
Dominion of Canada.
Carnegie Endowment for International Peace, Washington, D. C.
Carnegie Institution of Washington, Washington, D. C.
Central High School, Philadelphia.
Colonial Society of Massachusetts, Boston.
Columbia Broadcasting System, New York.
Dropsie College for Hebrew and Cognate Learning, Philadelphia.
E. I. duPont de Nemours Company, Wilmington, Delaware.
Edward W. Hazen Foundation, Haddam, Connecticut.
Friends of the Wissahickon, Philadelphia.
Franklin Savings Bank, New York.
Geographical Society of New South Wales, Sydney, Australia.
H. M. Stationery Office, London, England.
Historical Society of Pennsylvania, Philadelphia.
Indian Rights Association, Philadelphia.
Institut de Physique du Globe, Paris, France.
Instituto y Observatoria de Marina, San Fernando, Spain.
John Carter Brown Library, Providence, Rhode Island.
John Rylands Library, Manchester, England.
Kitasato Institute for Infectious Diseases, Tokyo, Japan.
Libraire Hachette, Paris, France.
Library Company of Philadelphia, Philadelphia.
Maurice and Laura Falk Foundation, Pittsburgh.
Mellon Institute, Pittsburgh.
Milbank Memorial Fund, New York.
Museum of Science and Industry, Chicago.
New York Meteorological Observatory, New York.
Observatorio Nacional, Havana, Cuba.
Ohio Biological Survey, Columbus, Ohio.
Pennsylvania Forestry Association, Philadelphia.
Pennsylvania Historical Commission, Harrisburg.
Commonwealth of Pennsylvania.
Penrose Research Laboratory, Philadelphia.
Philadelphia Bach Festival Society, Philadelphia.
Philadelphia Museum of Art, Philadelphia.
Rockefeller Foundation, New York.
Royal Observatory, Greenwich, England.
Slovak Council, London, England.
Social Science Research Council, New York.
Solar Physics Observatory, Kodaikanal, India.

Standard Oil Company, New York.
Union Library Catalogue of the Philadelphia Metropolitan Area, Philadelphia.
United States Government.
Universidad de Santo Domingo, Ciudad Trujillo, Dominican Republic.
Universidad Nacional Autónoma de Mexico, Mexico.
University of Maine, Orono, Maine.
Woods Hole Oceanographic Institute, Woods Hole, Massachusetts.
World Calendar Association, New York.
Zoological Society of Philadelphia, Philadelphia.

To all of these the Committee on the Library extends its sincere thanks.

Important Purchases Made by the Library.

The marked decrease in our purchases this year is to be attributed to the chaotic conditions abroad which have limited our importations, and also to the decision of the Committee on the Library to maintain a very conservative policy as to purchases until the Committee on Library Policy shall have submitted its report with recommendations.

Representative titles in the different classes are here given:

History of Science.

Agricola, Georg. De mensuris & ponderibus Romanorum atque Graecorum, lib.v. De externis mensuris & ponderibus, lib.ii. Ad ea, quae Andreas Alciatus denuo disputauit de mensuris & ponderibus, breuis defensio, lib.i. De mensuris, quibus interualla metimur, lib.i. De restituendis ponderibus atque mensuris, lib.i. De precio metallorum & monetis, lib.iii. [Colophon] Basileae, Apvd Hier. Frobenivm et Nic. Episcopivm, Anno M. D. L.

Bergman, Torbern Olof. Traité des affinités chymiques, ou attractions électives . . . A Paris, Chez Buisson . . . 1788.

[**Bevis**, John.] [Uranographia Britannica, or exact view of the heavens. ca. 1745–1750.]

Bianchini, Francesco. Hesperi et phosphori nova phaenomena, sive observationes circa planetam Veneris. Romae, Apud Joannem Mariam Salvioni . . . M D CC XXVIII.

Bode, Johann Elert. Uranographia, sive astrorum descriptio viginti tabulis aeneis incisa ex recentissimis et absolutissimis astronomorum observationibus. Berolini, Apud autorem, MDCCCI.

Boscovich, Ruggiero Giuseppe. [Collection of treatises on physics and astronomy.] 1745–1755.

—— —— Sopra il turbine che la notte tra gli xi, e xii Giugno del MDCCXLIX danneggiò una gran parte di Roma . . . In Roma, Appresso Niccolò, e Marco Pagliarini, MDCCXLIX.

Boyle, Robert. The origine of formes and qualities (according to the corpuscular philosophy) . . . Oxford, Printed by H. Hall . . . for Ric: Davis, An. Dom. MDCLXVI.

Castelli, Benedetto. Alcvni opvscoli filosofici. In Bologna, per Giacomo Monti, 1669.

Cometomantia; a discourse of comets . . . London, Printed for Brab. Aylmer . . . 1684.

[**Cruz**, Martin de la.] The Badianus manuscript . . . an Aztec herbal of 1552. Introduction, translation and annotations by Emily Walcott Emmart. Baltimore, Johns Hopkins Press, 1940.

Federici, Antonius. De causa mechanica, praecipuarum luminis proprietatum, elucubratio optico-physica. Romae, Typis Archangeli Casaletti ad S. Eustachium . . . MDCCLXXV.

Ferguson, James. The use of a new orrery. London, Printed for the author, M,DCC,XLVI.

Hill, John. Urania: or, A compleat view of the heavens . . . London: Printed for T. Gardner . . . M.DCC.LIV.

Laleu, Paul Yvon de. Propositions mathematiqves. A Paris, De l'Imprimerie de Lovis Sevestre . . . M. DC. XXXVIII.

Leeuwenhoek, Antoon van. Collected letters . . . ed. by a Committee of Dutch scientists. Pt. 1 + Amsterdam, Swets & Zeitlinger, 1939 +

Leybourn, William. An introduction to astronomy and geography . . . in VII parts. London: Printed by J. C. for Robert Morden and William Berry . . . 1675.

Martinelli, Domenico. Horologi elementari divisi in qvattro parti. Venetia, Per Bortolo Tramontino, M.DC.LXIX.

Niceron, Jean François. Thavmatvrgvs opticvs . . . Lvtetiae Parisiorvm, Typis & formis Francisci Langlois . . . M. DC. XLVI.

Nocetti, Carolus. De iride et aurora boreali . . . cum notis Josephi Rogerii Boscovich. Romae, Ex typographia Palladis, Excudebant Nicolaus et Marcus Palearini, MDCCXLVII.

Ornstein, Martha. The rôle of scientific societies in the seventeenth century. Chicago, University of Chicago Press, 1938.

Pascoli, Alessandro. Del moto, che ne i mobili si rifonde in virtu' di loro elastica possanza, trattato fisico-matematico . . . In Roma, Presso a Rocco Bernabò . . . MDCCXXV.

Porta, Giambattista della. De distillatione, lib. IX. Romae, Ex typographia Rev. Camerae Apostolicae, M. DC. VIII.

Rosse, William Parsons, 3d earl of. The scientific papers of William Parsons . . . 1800–1867, collected and republished by the Hon. Sir Charles Parsons. [Bradford . . . Lund, Humphries] 1926.

Saint Vincent, Gregory. Opus geometricum posthumum ad Mesolabium per rationum proportionalium novas proprietates . . . Gandavi, Typis Balduini Manilii . . . Anno 1668.

—— —— Opvs geometricvm qvadratvrae circvli et sectionvm coni decem libris comprehensum. Antverpiae, Apvd Ioannem et Iacobvm Mevrsios, Anno M. DC. XLVII. 2v.

Schott, Casparus. Organum mathematicum libris IX . . . Herbipoli, Sumptibus Johannis Andreae Endteri & Wolfgangi . . . Anno M. DC. LXVIII.

Schroeter, Johann Hieronymus. Selenotopographische Fragmente zur genauern Kenntniss der Mondfläche . . . Lilienthal bey demselben und in Commission bey Carl Gottfr. Fleckeisen . . . 1791–1802. 2v.

Stevin, Hendric. Wisconstich filosofisch bedryf . . . begrepen in veertien bocken. Tot Leyden, Gedruct by Philips de Cro-Y, in't Jaer 1667–1668. 2v.

Tory, Henry Marshall, ed. A history of science in Canada. Toronto, Ryerson Press, c1939.

Voiron. Histoire de l'astronomie, depuis 1781 jusqu'à 1811. Paris, Courcier, 1810.

Valerianus, Joannes Pierius. Compendivm in sphaeram. Parisiis, Apud Gulielmum Cauellat, in pingui Gallina, 1550.

Whiston, William. An account of a surprizing meteor, seen in the air, March the 6th, 1715/16, at night. London: Printed for J. Senex . . . and W. Taylor . . . 1716.

Wing, John. Scientia stellarum . . . London, Printed, for Awnsham and John Churchill . . . M DC XCIX.

Winthrop, John. Relation of a voyage from Boston to Newfoundland, for the observation of the transit of Venus, June 6, 1761. Boston: N.E. Printed and sold by Edes and Gill . . . M,DCC,LXI.

Art and Archaeology.

Bonnet, Hans. Die Waffen der Völker des alten Orients. Leipzig, Hinrichs, 1926.

British Museum. Dept. of Egyptian and Assyrian Antiquities. A Handbook to the Egyptian mummies and coffins exhibited in the British museum. London, British Museum, 1938.

Chiang, Yee. Chinese calligraphy. London, Methuen [1938].

The County Archaeologies, ed. by T. D. Kendrick—

Elgee, Frank. The archaeology of Yorkshire, by Frank and H. W. Elgee. London, Methuen [1933].

Hencken, Hugh O'Neill. The archaeology of Cornwall and Scilly. London, Methuen [1932].

Jessup, Ronald Frederick. The archaeology of Kent. London, Methuen [1930].

Peake, Harold John Edward. The archaeology of Berkshire. London, Methuen [1931].

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Hackin, Joseph. Recherches archéologiques à Begram. Paris, Les Editions d'Art et d'Histoire, 1939. 2v.

Kees, Hermann. Studien zur aegyptischen Provinzialkunst. Leipzig, Hinrichs, 1921.

Mercer, Samuel Alfred Browne. The Tell el-Amarna tablets, ed. by S. A. B. Mercer with the assistance of F. H. Hallock. Toronto, Macmillan, 1939. 2v.

Meux, Valerie Susie (Langdon), Lady. Some account of the collection of Egyptian antiquities in the possession of Lady Meux . . . , by E. A. Wallis Budge. London, Harrison, 1893.

Moortgat, Anton. Vorderasiatische Rollsiegel. Berlin, Mann, 1940.

Murray, Margaret Alice. Petra, the rock city of Edom. London . . . Blackie [1939].

Schäfer, Heinrich. Von ägyptischer Kunst . . . 3d Auf. Leipzig, Hinrichs, 1930.

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Smith, Earl Baldwin. Egyptian architecture as cultural expression. New York . . . Appleton-Century, 1938.

Wainwright, Gerald Averay. The sky-religion in Egypt. Cambridge, University Press, 1938.

Wijngaarden, W. D. van. Meesterwerken der egyptische Kunst te Leiden. Leiden, Sijthoff, 1938.

Wolf, Walther. Die Bewaffnung des altägyptischen Heeres. Leipzig, Hinrichs, 1926.

Biography, History and Travel.

Adams, James Truslow, ed. Dictionary of American history. New York, Scribner's Sons, 1940. 5v and ind.

Carter, Robert. Letters . . . 1720–1727; the commercial interests of a Virginia gentleman, ed. by L. B. Wright. San Marino, Calif., Huntington Library, 1940.

Childs, Frances Sergeant. French refugee life in the United States, 1790–1800. Baltimore, Johns Hopkins Press, 1940.

Crowther, James Gerald. Famous American men of science. New York, Norton [1937].

Dunbar, William. Life, letters and papers . . . comp. . . . by Mrs. Dunbar Rowland. Jackson, Miss., Mississippi Historical Society, 1930.

Eve, Arthur Stewart. Rutherford. New York, Macmillan . . . 1939.

France. Ministère des Affaires Étrangères. Despatches and instructions of Conrad Alexandre Gérard, 1778–1780 . . . with an . . . introduction and notes by J. J. Meng. Baltimore, Johns Hopkins Press, 1939.

Gipson, Lawrence Henry. Zones of international friction, North America, south of the great lakes region, 1748–1754. New York, Knopf, 1939.

Harden, William. A history of Savannah and south Georgia. Chicago, Lewis, 1913. 2v.

Knollenberg, Bernhard. Washington and the revolution; a reappraisal. New York, Macmillan, 1940.

O'Donnell, William Emmett. The Chevalier de La Luzerne, French minister to the United States, 1779–1784. Bruges, Desclée de Brouwer . . . 1938.

Pennsylvania Lives—

Earnest, Ernest. John and William Bartram . . . Philadelphia, University of Pennsylvania Press, 1940.

Gaul, Harriet A. John Alfred Brashear . . . by H. A. Gaul and Ruby Eiseman. Philadelphia, University of Pennsylvania Press, 1940.

Tinkcom, Harry Marlin. John White Geary . . . Philadelphia, University of Pennsylvania Press, 1940.

Serle, Ambrose. The American journal of Ambrose Serle, secretary to Lord Howe, 1776–1778, ed . . . by E. H. Tatum, jr. San Marino, Calif., Huntington Library, 1940.

Thomson, Sir Joseph John. Recollections and reflections. New York, Macmillan, 1937.

Tocqueville, Alexis Charles Henri Maurice Clérel de. Memoirs, letters, and remains . . . tr. from the French by the translator of Napoleon's correspondence with King Joseph. Boston, Ticknor and Fields, 1862. 2v.

Turner, Frederick Jackson. The early writings . . . with a list of all his works, comp. by E. E. Edwards. Madison, University of Wisconsin Press, 1938.

U. S. President. Jefferson, Thomas. The address of Thomas Jefferson, to the Senate . . . delivered . . . on the 4th day of March, 1801, on his taking the oath of office, as president of the United States of America. Baltimore, Printed for Keatinge's Book-Store, 1801.

Weiss, Harry Bischoff. Thomas Say . . . by H. B. Weiss and G. M. Ziegler. Springfield, Ill. . . . Thomas [1931].

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Brown, Lloyd Arnold. Notes on the care & cataloguing of old maps. Windham, Conn., Hawthorn House, 1940.

Caspar, Max. Bibliographia Kepleriana . . . München, Beck, 1936.

International Committee of Historical Sciences. World list of historical periodicals and bibliographies . . . ed. by P. Caron and M. Jaryc. Oxford, International Committee of Historical Sciences, 1939.

Stillwell, Margaret Bingham, ed. Incunabula in American libraries; a second census of fifteenth-century books . . . New York, Bibliographical Society of America, 1940.

Who's who in America—current biographical reference service; quarterly cumulation. Ser. 1, No. 1+ Chicago, Marquis, 1940+

Williams, Cecil Brown. A research manual . . . by C. B. Williams . . . [and] A. H. Stevenson. New York . . . Harper [1940].

In addition to the above mentioned purchases the Society has subscribed to all of the publications in print of the International Institute of Intellectual Cooperation, with future ones to be supplied as issued. The initial order consisted of ninety-two volumes and pamphlets and twenty-three serial titles. While a few of these publications are found in various libraries throughout the city, this acquisition will fill a decided lacuna in the Philadelphia area.

It is not often that the Society deliberates more than a hundred years before purchasing an item to which its special attention has been called. Early in the year 1791 there was received a notice from Carl Gottfried Fleckeisen,[1] a bookseller in Helmstädt, Germany, enclosing an advertisement of a study on the surface of the moon by Johann Hieronymus Schroeter,[2] and soliciting subscriptions for the work. Although the Society responded in part to this plea by ordering "that the Advertisement be published in the German and other Newspapers"[3] it apparently failed to enter its own subscription. This year a copy of the volume published in 1791 together with Volume 2 which appeared in 1802 was purchased.

It seems appropriate to mention here a work which, although not a recent acquisition, has been noted in our holdings for the first time. This is the very rare *Histoire Naturelle des Quadrupèdes Ovipares*, by François Marie Daudin, consisting of two livraisons composed of twenty-four unnumbered pages and twelve plates, published in Paris in 1800 (An viii–ix). To Dr. Francis Harper, of the Academy of Natural Sciences, goes the credit for discovering this rare item which had been purchased for the Society by George Ord in 1837 bound with a copy of Daudin's *Rainettes*[4] and treated by the early cataloguer as part of that work. According to Dr.

[1] Ms. Communications to the Amer. Philos. Soc., Mathematics and Astronomy, V. 2, 28.

[2] Schroeter, J. H. *Selenotopographische Fragmente* . . . Lilienthal . . . 1791–1802. 2v.

[3] Early Minutes of the Amer. Philos. Soc., Proc., 22, 3 (1884), 188.

[4] *Histoire Naturelle des Rainettes* . . . Paris, Levrault, An xi.

Harper [1] there is no other copy of the work in the United States, and even the Muséum National d'Histoire Naturelle of Paris has only the first livraison.

Printed Frankliniana.

Among the year's important acquisitions in Frankliniana is a rare 1740 imprint (Evans, 4523)—*The Speech of the Speaker of the House of Commons, upon Presenting the Money Bills to His Majesty, April 29, 1740* [and the resolutions of the Pennsylvania Assembly thereon]. This copy formerly belonged to the late John Gribbel, and as far as is known is the only one extant. An edition of *A Monitor for an Apprentice*, containing two essays by Dr. Franklin, published in Boston in 1808, an undated London edition of the *Art of Swimming* in which may be found Franklin's "Advice to Bathers," and a copy of *The Way to Wealth*, Bermondsey, Surry, Brightly and Donkin, 1819, were acquired. This last item brings the number of the Society's editions of that work to twenty-five.

From Dr. Dixon Wecter and Dr. George S. Wykoff came reprints of articles on Franklin, much of the material for which was drawn from our Franklin Papers. Dr. Wecter's articles are entitled, "Francis Hopkinson and Benjamin Franklin," [2] and "Burke, Franklin, and Samuel Petrie"; [3] that of Dr. Wykoff, "Problems Concerning Franklin's 'A Dialogue Between Britain, France, Spain, Holland, Saxony, and America.'" [4] A group of lectures for young people, Dr. Dayton C. Miller's *Sparks, Lightning, Cosmic Rays*, [5] contains a substantial amount of well popularized material on Franklin's scientific experiments.

Acquisition of Serials.

This Library maintains an exchange of publications with 607 learned societies, universities, institutions, etc., from which it has received 1,260 serial titles during the past year; 209 titles have been received as gifts, and 347 by purchase. The last are credited to the various funds as stated above. Sixty-six new serials have been added during 1940. Among them are the following:

[1] Some Works of Bartram, Daudin, Latreille, and Sonnini, and their Bearing upon North American Herpetological Nomenclature. *The American Midland Naturalist*, 23, 3 (May 1940), 692–723.

[2] *American Literature*, 12, 2 (May 1940), 200–217.

[3] *Huntington Library Quarterly*, 3, 3 (April 1940), 315–338.

[4] *American Literature*, 11, 4 (January 1940), 439–448.

[5] New York, Macmillan, 1939.

By Purchase.

Gennadeion monographs . . . published for the American School of Classical Studies at Athens. No. 1 + Cambridge, Mass., 1940 +

Inter-American Bibliographical and Library Association. Publications. Ser. 2, V. 1 + New York, 1938 +

Photo technique. V. 2, no. 3 + New York, 1940 +

Studi romani; rivista di archeologia e storia. An. 1, fasc. 1–An. 3, fasc. 2. Roma, 1913–1922.

By Exchange.

Anthropological Society of Tokyo. Anthropological papers—B. Prehistory. No. 2 + Tokyo, 1939 +

Arquivos de zoologia de estado de São Paulo. V. 1 + São Paulo, 1940 +

Commonwealth review. V. 21 + Eugene, Ore., University of Oregon, 1939 +

Copenhagen. K. Danske Videnskabernes Selskab. Biologiske skrifter. Bd. 1 + København, 1939 +

Indiana Historical Society. Prehistory research series. V. 1 + Indianapolis, 1937 +

Louisiana State University. Bureau of Government Research. This is your government. No. 1 + Baton Rouge, 1940 +

R. Societas Scientiarum Upsaliensis. Årsbok, 1939 + Uppsala, 1939 +

U. S. Agricultural Marketing Service. Report, 1939 + Washington, 1939 +

University of Colorado. Studies—Series D. Physical and biological sciences. V. 1 + Boulder, Colo., 1940 +

University of Indiana. Kirkwood Observatory. Publications. No. 1 + Bloomington, Ind., 1939 +

University of Oregon. Monographs—Studies in economics. No. 1 + Eugene, Ore., 1940 +

By Gift.

Canada. Meteorological Service. Record of observations at the magnetic observatories Agincourt and Meanook, 1930 + Ottawa, 1939 +

National Geographic Society. Mexican archaeology series. V. 1 + Washington, 1940 +

Pennsylvania. Topographic and Geologic Survey. Progress report. No. 123 + Harrisburg, 1939 +

Union Library Catalogue of the Philadelphia Metropolitan Area. Check list of desiderata. No. 1 + Philadelphia, 1940 +

War Documentation Service. Bulletin. No. 1–4. Philadelphia, 1940.

Wellington, N. Z. Carter Observatory. Astronomical bulletin. No. 1 + Wellington, 1940 +

—— Reprint. No. 1 + Wellington, 1940 +

Files Completed.

Through purchase and exchange the following files have been completed:

New York Historical Society. Collections—Publication fund series. V. 2–3. New York, 1869–1870. (By exchange.)

U. S. National Archives. The Federal register. V. 1–2. Washington, 1936–1937. (By purchase.)

University of Indiana. Studies. Nos. 1–8, 38, 56–57, 66–68, 79, 93–95, 114–122. Bloomington, Ind., 1910–1938. (By exchange.)

G. E. Stechert & Company have reported that publication of the following serials has been suspended, at least temporarily, and they have refunded the money paid for subscriptions for 1940:

Annales des sciences naturelles botanique.
L'Anthropologie.
L'Antiquité classique.
Athar-e-Iran.
Bulletin astronomique.
Géographie.
Revue de droit international et de législation comparée.
Revue des études latines.
Revue française heraldique et de sigillographie.
Société Botanique de France. Bulletin.

Binding, Cataloguing, etc.

During 1940, 788 volumes have been bound. There have been catalogued 419 books in 646 volumes, 158 pamphlets, 8 maps, 13 manuscripts, 12 autographs, 15 bookplates, 8 photostats, 3 broadsides, and 2 microfilms. Of serials analyzed, 1,727 titles have been brought out; 8,316 cards have been added to the catalogue. Of these 1,334 were typewritten and 6,982 were Library of Congress cards to which changes and additions were made to adapt them to our catalogue.

Calendaring of Manuscripts.

The indexing of the Bache Collection of Franklin Papers has progressed. Although the Calendar is not yet ready for publication, the Papers have been consulted by an increasing number of persons this year.

In addition to this work a group of papers belonging to the late Dr. R. A. F. Penrose, Jr., was catalogued. This collection, consisting of ninety items and covering the period 1863–1931, includes correspondence, papers by Dr. Penrose and biographical material. It

was presented to the Society by the Penrose Estate a short time after Dr. Penrose's death.

About four hundred pieces of the Burd-Shippen Papers, consisting of receipts and fragments of letters, remained when the bulk of the material was bound in three volumes many years ago. These are now in the process of being calendared.

In-Use and Out-Use of the Library.

During the year 1940 the total number of recorded readers in the Library was 488. They consulted 1,503 printed[1] and 1,427 manuscript items.[1] In addition replies were made to 151 inquiries received through correspondence, exclusive of requests for photo-duplication service. Thirty-eight volumes were lent to members of the Society, 100 volumes to the staff, and 200 volumes upon interlibrary loan; 44 volumes were borrowed upon interlibrary loan.

Each year the Library is able to point with satisfaction to a greater use of its services. Although the number of readers shows an advance of only 13 over the number recorded last year, there was a decided increase in the number of items used. Interlibrary loans rose from 37 in 1939 to 61 in 1940, while the number of volumes lent was doubled. The photoduplication service filled 74 orders this year against 60 in 1939.

Manuscripts Consulted.

Among the collections of manuscripts most frequently consulted during the year are:

American Philosophical Society. Archives.
Samuel Breck. Historical Sketch of the Continental Bills of Credit.
—— Recollections of Deceased members of the American Philosophical Society.
Burd-Shippen Papers.
Franklin Papers, including the Bache Collection.
Greene Papers.
Horsfield Papers.
James Hutchinson. Diary.
Indian Vocabularies.
Jefferson Papers.
Burton Alva Konkle. Life and writings of James Wilson.
Lee Papers.
Lewis and Clark Journals.
James Logan. Correspondence.

[1] Of these, 404 printed and 215 manuscript items were used by workers of the Historical Records Survey and other W.P.A. projects.

Material Pertaining to the Boundary Line between Pennsylvania and Maryland.
André Michaux. Botanical Journal.
Jasper Moylan Papers.
G. H. E. Muhlenberg. Botanical Journals.
Israel Pemberton. Letter Book.
Penn Papers.
David Rittenhouse. Meteorological Observations.
Thomas Sullivan. Journal of the Operations of the American War from 1775–1778.
Weedon Papers.
Caspar Wistar Papers.
Wistar Association. Archives.

Interlibrary Loan.

The following institutions have borrowed material upon interlibrary loan:

Academy of Natural Sciences, Philadelphia.
Aluminum Company of America, New Kensington, Pennsylvania.
Atlantic Refining Company, Philadelphia.
Bryn Mawr College, Bryn Mawr, Pennsylvania.
Children's Hospital of Philadelphia, Philadelphia.
Curtis Publishing Company, Philadelphia.
Eastern Baptist Theological Seminary, Overbrook, Philadelphia.
Geological Society of America, New York.
Girard College, Philadelphia.
Harvard University, Cambridge, Massachusetts.
Historical Records Survey (W.P.A.), Philadelphia.
Historical Society of Pennsylvania, Philadelphia.
Library Company of Philadelphia, Philadelphia.
Library of Congress, Washington, D. C.
National Research Project (W.P.A.), Philadelphia.
Princeton University, Princeton, New Jersey.
Swarthmore College, Swarthmore, Pennsylvania.
Temple University, Philadelphia.
Union Library Catalogue of the Philadelphia Metropolitan Area, Philadelphia.
University of Pennsylvania, Philadelphia.

The American Philosophical Society has borrowed material upon interlibrary loan from the following:

Dropsie College for Hebrew and Cognate Learning, Philadelphia.
Free Library of Philadelphia, Philadelphia.
Harvard University, Cambridge, Massachusetts.
Haverford College, Haverford, Pennsylvania.
Library Company of Philadelphia, Philadelphia.
Mercantile Library, Philadelphia.

Pedagogical Library, Philadelphia.
Pennsylvania School of Social Work, Philadelphia.
Philadelphia Bar Association, Philadelphia.
Temple University, Philadelphia.
University of Pennsylvania, Philadelphia.

Exhibits of Books and Manuscripts from the Library.

Midwinter Meeting, February 23–24, 1940.
Material relating to the Wilkes Exploring Expedition of the U. S. Navy, 1838–1842.

Jayne Memorial Lecture, Delivered by Dr. Francis Randolph Packard on the Conquest of Surgical Pain, March 27, 1940.
Medical Americana and early works on surgery.

Annual General Meeting, April 18–20, 1940.
Books illustrating the history of printing in colonial America.

Exhibition in Honor of the Eighth American Scientific Congress, May 20–22, 1940.
Material pertaining to South American history and travel in the 18th and 19th centuries.

Exhibition in Honor of the Bicentenary Celebration of the University of Pennsylvania, September 16–23, 1940.
Books and manuscripts relating to the history of the University.

Autumn General Meeting, November 22–23, 1940.
Books presenting aspects of the presidency of the United States, from Washington to Van Buren.

Financial Statement.

Books and Binding and General Expenses.

Carried forward from 1939	$ 2,851.41
Appropriation for 1940	10,000.00
	$12,851.41
Expended during 1940	7,526.81 [1]
Balance 12/31/40	$ 5,324.60

Special Library Funds.

Balances 1/1/40	Income	Expended	Transferred to Principal	Balances 12/31/40
$10,236.34	$7,492.54	$2,229.52	$804.82	$14,694.54

Salaries.

For 1940	$8,770.00

[1] Includes the salary of the photographer.

Staff of the Library.

The Library staff consists of Miss Laura E. Hanson, *Librarian*, Mrs. Gertrude D. Hess, *Assistant Librarian*, Mrs. Ruth A. Duncan, and Mrs. Mary C. Dothard. In addition to the regular staff, Dr. Alban W. Hoopes is engaged on special archival work and Dr. John J. Heilemann on the photoduplication service.

II. Report of the Chairman of the Committee on the Library

The Library Committee: Personnel, Meetings and Policy.

Four regular meetings of the Committee on the Library were held at two o'clock on the afternoons of March 20, May 20, October 23, and December 18, 1940.

The membership of the Committee consists of St. George L. Sioussat, *Chairman*, George A. Barton, Rhys Carpenter, Waldo G. Leland, William E. Lingelbach, J. Percy Moore,[1] Horace C. Richards, A. S. W. Rosenbach, and Roland S. Morris, *President;* Edwin G. Conklin, *Executive Officer*, sits with the Committee.

The Committee wishes here to record its deep sorrow and sense of loss caused by the death of Dr. Rodney H. True on April 8, 1940. Dr. True had served very faithfully and helpfully on this Committee from 1932 until 1939 when ill health caused his resignation.

The usual matters of routine have come before the Committee, and the results of its deliberations have already been noted in the report of the Librarian.

The Archives of the Society.[2]

The calendaring of the archival material has progressed steadily to the year 1840 (with a number of items up to 1880) along the lines described in detail in last year's Report. In order to minimize any confusion arising from over-classification, the archives and manuscript collections have been limited to three basic groups: letters, documents and communications. To date 550 archival letters from 1768 to 1845 and 475 manuscript letters from 1744 to 1839 have been listed. Among the material recently added are 114 letters covering the period 1769 to 1838, concerned with miscellaneous donations to the Society. In this group are five letters addressed to Benjamin Franklin, as president of the Society, and six

[1] Dr. J. Percy Moore was appointed a member of the Committee in December 1940.

[2] Summarized from a report submitted by Dr. Alban W. Hoopes.

holograph letters of Thomas Jefferson. The latter, written from Washington during the years 1805–1807 while Mr. Jefferson was president of the Society as well as of the United States, show the continued interest in science of one necessarily preoccupied with public affairs; "prickly lizards" and mammoth bones were deemed still worthy of investigation.

A total of 254 archival and 49 manuscript documents has been enumerated. Foremost in historical interest are the items regarding the building of Philosophical Hall and its subsequent history. Included are the subscription lists of July 11, 1785, and July 4, 1786, and the accounts of the Society with Samuel Vaughan to December 1787. Some facts concerning the lease of certain rooms in the Hall to John Vaughan and later to Charles Willson Peale and Thomas Sully may be gleaned from this collection. Unfortunately, many gaps exist. A beginning has been made also in the study of old financial papers of the Society. This collection is of value not only as a record of the financial affairs of the Society, but also for the light it throws upon other aspects of the Society's progress. Receipts for books purchased—as, for example, those bought at the Dufief sales of 1801 and 1803 (books from Franklin's library)—add considerably to the knowledge of the growth of the Library; receipts for various kinds of building materials fill in details regarding the erection of Philosophical Hall.

The widespread connections and varied activities of the members of the American Philosophical Society have resulted in a proportionate dispersion of manuscripts relating to the Society or written to or by its members. A thorough survey of the Society's archives should take into account relevant material in other libraries within the Philadelphia area. Such an investigation has been started at the Academy of Natural Sciences. Preliminary examination has brought to light material relating to Samuel S. Haldeman (1844–1880),[1] Thomas Say (1817–1834), Isaac Lea (1828–1886), John K. Townsend, and C. S. Rafinesque. The John K. Townsend letters report on an expedition to the west which was made in 1834 by Townsend and Thomas Nuttall (1817–1859) under the joint auspices of the Academy of Natural Sciences and the American Philosophical Society. The Rafinesque material relates to the herbarium owned at one time by Zaccheus Collins (1804–

[1] Dates in parentheses show membership in the Amer. Philos. Soc.

1831) which had been deposited with this Society from 1834 to 1837.

So much for a beginning. It is believed that more extended research into the manuscript depositories in Philadelphia will add materially to the fund of knowledge concerning the history of local scientific and cultural development, as well as to a more satisfactory understanding of the relationship of the Society therewith.

Photoduplication Service.[1]

During the year the Photoduplication Service has filled 74 orders, comprising 2,546 frames of microfilm, 1,433 enlargements and 17 lantern slides. Receipts amounted to $203.52; the value of the work done for the Society totaled approximately an equal amount.

The Photorecord camera has been equipped with a $2\frac{1}{4}'' \times 3\frac{1}{4}''$ plate holder, making it possible to make negatives of a size large enough to yield satisfactory prints of difficult material. Preliminary experiments have been carried on with the idea of developing a process for preserving papers by lamination with a thermoplastic material.

Acquisition of Manuscript Material.

To our Franklin Papers this year has been added a series of three items relative to that phase of Franklin's life which was connected with the postal service. On August 14, 1775, the General Court of Massachusetts informed Nicholas Cooke, governor of Rhode Island, that mail from Cambridge had been intercepted by a British man-of-war, and requested a change in the mail route. On the following day, August 15, Governor Cooke wrote to B. Franklin about the mail robbery and recommended a new route. On August 27, in Philadelphia, Franklin acknowledged this letter. This last item is particularly interesting inasmuch as it gives proof of Franklin's active service in the post office department barely a month after receiving his appointment as postmaster-general from the Continental Congress on July 26, 1775. It will be remembered that this was not Franklin's first experience with postal matters. In 1737 he had been appointed postmaster of Philadelphia by the British crown, and in 1753 had been raised to the position of deputy postmaster-general of the American colonies which office

[1] Summarized from a report submitted by Dr. John J. Heilemann.

he held until his commission was withdrawn in 1774. Although Franklin retired from active post office duty when he sailed for France in 1776, he was called upon at least twice later in life for advice regarding the service. In 1777, Franklin, Silas Deane and Arthur Lee on the one part, and LeRay de Chaumont on the other, signed a contract for a monthly packet service between France and America. Again in 1783–1784 much correspondence took place between Anthony Todd, Secretary of the General Post Office, and Franklin relative to the resumption of mail service between England and America involving a postal treaty entered upon by France, England and America. Interesting details of both of these later transactions are to be found in the Bache Collection of Franklin Papers.

Another Franklin purchase of considerable historical importance is a letter addressed from Philadelphia on June 3, 1776, a month before the signing of the Declaration of Independence, to William Bingham who was at the time Continental agent in the West Indies. The letter, signed by B. Franklin, Benj. Harrison, John Dickinson, and Robt. Morris, contained instructions from the Secret Committee of Correspondence for the purchase of arms to be used by the colonies.

As in former years copies as well as original material have been added to the Franklin Collection. Through the kindness of Mrs. Addinell Hewson and Miss Katharine Bradford, we were able to examine a group of letters belonging to the family of Mrs. Mary Hewson (née Polly Stevenson, daughter of Franklin's English landlady, Margaret Stevenson) with permission to microfilm any of the material which would supplement our Franklin Papers. Nearly half of the collection, numbering about 375 items and ranging in date from 1761 to 1847, was found to have sufficient association value to be microfilmed. Enlargement prints were made of some forty of the microfilmed items, copies of which were given to Mrs. Hewson and Miss Bradford. As the collection is to be divided among various descendants, Mrs. Hewson has further cooperated by noting for the Society, as a matter of record, the names of persons to whom specific pieces are to be given.

Other reproductions which have been acquired include a letter from Franklin to Jonathan Williams, Jr., Passy, November 30, 1777, pertaining to the purchase of supplies for the American army; a letter from Franklin to Joseph Greenleaf, Cambridge, October 26,

1775, relative to postal affairs; and Franklin's plan for an American colonial paper currency written about 1764.

More than a hundred years ago, in 1817, there were presented to the Society by Daniel Parker, then Adjutant and Inspector General of the United States Army, three journals dealing with the exploration of the west during the years 1804–1806. These journals record the expeditions made by Zebulon Pike from St. Louis to the source of the Mississippi in the years 1805 and 1806; by William Dunbar from St. Catherine's Landing on the Mississippi up the Washita River as far as the Hot Springs in Arkansas in 1804 and 1805; and by George Hunter who accompanied William Dunbar on the journey up the Washita. Although each of these journeys was undertaken upon government commission which would lead one to believe that an official report had been required, Daniel Parker in presenting the manuscripts writes: "I have no means of determining how these journals found a deposit in this Office and they are so little connected with its records that I am induced to request you to offer them to the Library of the American Philosophical Society."[1]

Opportunity was given the Society during the year to augment this collection of early western travels by the purchase of four manuscript notebooks in which George Hunter recorded the details of trips which he made during the years 1796 to 1809. The earliest of these describes a journey which he took to Kentucky and the Illinois country, leaving Philadelphia on July 14, 1796. October 16 of the same year found him on the return journey after having traveled as far west as the Mississippi River near the village of Kaskaskia. Another journey over some of the same territory was taken by Dr. Hunter and his son, George H. Hunter, beginning on August 19, 1802, when they set out from Philadelphia for Lexington, Kentucky. On October 26, the last entry for this particular trip, they were still in Lexington where they had made a prolonged stay to settle the estate of a relative. The third and longest of the journals is that in which Hunter kept his field notes of the exploring trip made with William Dunbar. On May 27, 1804, he left Philadelphia for Natchez where he joined Dunbar at his home "The Forrest" on September 25, and after a short delay proceeded on the expedition. In this journal Hunter transcribed letters to Henry Dearborn, Secretary of War, relating to the trip, gave a

[1] D. Parker to James Cutbush, June 14, 1817—Ms. Archives.

detailed description of the building of a boat which carried them to Natchez, as well as the day by day record of sights seen, the weather, etc. The last entry was made on March 27, 1805, upon reaching New York, after an absence of ten months during which a distance of more than 7,000 miles had been covered. It was presumably from this rough journal that the official copy presented to the Society in 1817 was made. The last trip to be recorded was a journey to the upper Louisiana begun on July 29, 1809, by George Hunter accompanied again by his son. The account of this journey, of short duration, was kept by the son and was terminated on August 3 of the same year.

In addition to previous gifts from her husband's papers Mrs. Henry H. Donaldson has presented a typed manuscript of reminiscences, bound and entitled, "Memories for my boys—Henry H. Donaldson, 1931"; numerous biographical and genealogical notes; papers and poetry by Dr. Donaldson; eight letters of the period 1869–1932; and abstracts of letters from Dr. Donaldson to his wife supplementary to the Diaries presented last year.

To the Elihu Thomson Papers has been added a group of letters from George W. Hewitt to Dr. Thomson and thirty certificates of award.

The Centenary Celebration of the Wilkes Exploring Expedition of the United States Navy, 1838–1842, held by the Society on February 23–24, 1940, brought to the Library from Mr. Charles Denby Wilkes of Paris, descendant of Capt. Charles Wilkes, photostats of six items of Wilkes memorabilia in his possession.

Cooperative Activities.

Upon the recommendation of the Academy of Natural Sciences of Philadelphia, this Library has ordered Alexander Zahlbruckner's *Catalogus Lichenum Universalis*, Leipzig, 1922–1934, 9v. and index; Antoni van Leeuwenhoek's *Collected Letters*, to be published in twenty volumes; *Wissenschaftliche Ergebnisse der Oldoway-Expedition, 1913*, edited by H. Reck; and a complete set of the publications of the Sino-Swedish Expedition to northwestern China under the direction of Sven Hedin.

From the Academy of Natural Sciences also came a memorandum from its *Proceedings* for 1857 which reads:

A letter was read from Rev. E. J. Lowe, dated Observatory, Beeston, near Nottingham (England), Jan. 7th, 1857, containing the following passage:

—"The late Mr. Lawson, F.R.S., left me his valuable collection of Meteorological Instruments, amongst which are Dr. Benjamin Franklin's Hygrometer, which is in as good working order as on the day it was made, an Electric Kite belonging to Dr. Franklin, and several letters. Mr. Lawson had a card placed on the hygrometer with the following inscription, 'Invented by and belonged to Dr. Benjamin Franklin, the Patriot of Philadelphia.' I have mentioned this, thinking that you would feel an interest as American Philosophers in the information respecting the instruments of that glorious philosopher Dr. Franklin."

Appeals made to various Franklin scholars for information pertaining to the present location of this material have brought many suggestions, several of which have not been followed through owing to war conditions. Perhaps some reader of this Report may have a clue.

4. REPORT OF THE COMMITTEE ON PUBLICATIONS

The members of the Committee for 1940–41 are as follows: Jacob R. Schramm, *Chairman*, Frank Aydelotte, Edwin G. Conklin, Franklin Edgerton, Benjamin D. Meritt, John A. Miller, Ernest M. Patterson, Conyers Read, Harold C. Urey, James T. Young, Roland S. Morris, *President*, and Arthur W. Goodspeed, *Editor*.

Dr. Cyrus Adler, Vice-president of the Society, had served as Chairman of the Committee after the death of Dr. Donaldson who had previously served in that capacity. Owing to the death of Dr. Adler in March, 1940, the President appointed as Chairman of the Committee Dr. Jacob R. Schramm.

Five regular meetings of the Committee were held during the year, namely, on February 12, April 8, May 6, October 5, and December 7. It was decided that the Committee on Publications should not be burdened with the duties of accepting or rejecting manuscripts which are offered for publication, but that there should be appointed an Editorial Board for this purpose representing the four Classes of the Society. Accordingly, at the meeting on October 5 the Committee appointed the following Board of Editors for all the publications of the Society:

Editor-in-Chief	Edwin G. Conklin
Editor—Class I	Karl K. Darrow
Class II	D. H. Tennent †
Class III	E. M. Patterson
Class IV	Rhys Carpenter
Managing Editor	Arthur W. Goodspeed

Fortunately, all of these persons have found it possible to accept and hereafter the onerous duties of reading and passing upon the various manuscripts that are offered will be handled by the Editorial Board. It was voted at the same time that the names of the Editorial Board should be printed on the reverse of the title page of each of the publications of the Society.

Matters of general policy which were discussed by the Committee at its various meetings centered largely upon the question as to whether it is desirable to enter the fields now occupied by the

† Deceased January 14, 1941.

various specialized research journals of the country where there are excellent opportunities for the publication of such research papers. It is reasonable that investigators should prefer to publish their papers in these special journals rather than to submit them for publication by a general society where they would necessarily appear along with papers in many other fields. These discussions led to a resolution adopted by the Committee at its meeting on May 6 that the members of the Society should be circularized with respect to their desires regarding the best manner of publication of the PROCEEDINGS. Accordingly, in June the following letter and questionnaire was sent to the resident members:

To the Members of the
American Philosophical Society
Dear Sirs:

For several years past there has been much discussion of the publication program of the Society and of possible methods of improving it (see YEAR BOOK, 1937, pp. 110–112; 1938, pp. 82–115; 1939, pp. 60–79 and 141–146).

The serial publications of the Society are the TRANSACTIONS, PROCEEDINGS, MEMOIRS and YEAR BOOK. The TRANSACTIONS is the oldest scientific journal in America, having been started in 1769. Six volumes were published between 1771 and 1809 in a first series, and thirty-one volumes from 1818 to date in a second series in enlarged format. Its quarto size makes it suitable for the publication of monographs requiring large maps or plates. Every contribution is issued as a separate number and, while it is open to contributions in all fields of learning, the numbers can be distributed selectively to institutions and individuals especially interested.

The PROCEEDINGS was started in 1838 and is at present in its eighty-second volume. It has from its beginning contained original articles as well as lectures and symposia offered at the meetings of the Society; until 1936 it also contained abstracts of the minutes of the business meetings, lists of members, obituaries, etc., but all this has now been transferred to the YEAR BOOK, leaving only original articles, usually of a general rather than of a highly specific character, symposia, etc., for publication in the PROCEEDINGS.

The MEMOIRS, started in 1935, is intended for monographs and volumes of book size. Every MEMOIR is complete in itself and thirteen have been issued to date.

There seems to be general approval of the policy of maintaining the present character of the TRANSACTIONS, MEMOIRS and YEAR BOOK, but apparently there is much diversity of opinion among members of the Society as to the proper aims and methods in the publication of the PROCEEDINGS.

In order to obtain the opinions of members, the enclosed questionnaire is being sent to all resident members of the Society.

Sincerely yours,

EDWIN G. CONKLIN,
Executive Officer

The Committee on Publications of the American Philosophical Society has voted to canvass the resident members of the Society as to their desires concerning the objectives and manner of publication of the PROCEEDINGS. Will you please check the statements below as you prefer and return this form with your signature to the Executive Officer before June 25, 1940.

—— 1. Should the objective be the publication of such papers as are read at the meetings which their authors attempt to make generally intelligible by presenting summaries and conclusions rather than details?

—— 2. Or should the aim be to publish the details of the latest researches in the many fields represented by the Society as is now the practice in the specialized journals?

—— 3. Should the Society continue to publish in the PROCEEDINGS longer and more mature papers than can now be published in existing journals?

—— 4. What combination of these objectives or what other objectives can you propose? (Write your suggestions on the other side of this sheet.)

—— 5. Shall the Society continue to publish a single series of the PROCEEDINGS?

—— 6. Or shall the Society establish a series for each of the four Classes in the Society?

—— 7. Or one series for Classes I and II, and another for Classes III and IV?

—— 8. In case a single series is maintained, shall the Society publish in separate numbers the papers in each of the four Classes?

—— 9. Or shall the Society continue to group related subjects together, as much as possible, as is done in the programs of the meetings?

The Committee on Publications would welcome any suggestions from the members that will make the publications more useful.

The total number of members who replied to this questionnaire was one hundred and forty-five and the sentiment expressed was more than two to one for retaining a single series of the PROCEEDINGS. Dr. Schramm has undertaken to analyze the returns for each of the questions and will present the results at a future gen-

eral meeting of the Society. It is evident, however, from this great preponderance of votes for retaining the PROCEEDINGS in a single series that there is no ground for recommending a change at this time. Other matters which are still being considered by the Committee and upon which we may expect reports from the Chairman are concerned with format, style, cost of publications, etc. One of the questions of policy which has occupied much of the attention of the Committee has been the increasing demands from other publications for subsidies in these times of stress. The Committee has hitherto attempted to maintain the position that it cannot subsidize publications other than those which are issued by the Society but in a few instances departure has been made from this principle and this has increased applications so that the Committee is now receiving many appeals to aid most worthy publications by subsidies. This is a matter which is sure to continue to occupy the attention of the Committee in the near future. In general, the Committee on Publications has taken the ground that applications for subsidies for publications should be made to the Committee on Research rather than to the Committee on Publications.

Twenty-six manuscripts were accepted for publication as follows:

In the PROCEEDINGS	22 papers
TRANSACTIONS	2 monographs
MEMOIRS	2 volumes

Eleven manuscripts were considered and declined.

During the year the following contributions were published:

TRANSACTIONS:

Volume XXVIII. William B. Scott and Glenn L. Jepsen. The Mammalian Fauna of the White River Oligocene.

Pt. 3. April, 1940.

Lagomorpha by Albert E. Wood. 92 pp., 2 pls., 47 figs.

Pt. 4. April, 1940.

Artiodactyla by William B. Scott. 384 pp., 44 pls., 19 figs.

Volume XXXI, Pt. 3. December, 1940.

Henry B. Bigelow, Lois C. Lillick and Mary Sears. Phytoplankton and Planktonic Protozoa of the Offshore Waters of the Gulf of Maine. 89 pp., 13 figs.

Pt. 4. December, 1940.

Samuel Eliot Morison. The Route of Columbus Along the North Coast of Haiti, and the Site of Navidad. 47 pp., 10 pls., 7 maps.

H. R. Seiwell. Time Variability of Hydrographic-Elements Determining the Dynamic Situation in the Western North Atlantic. pp. 369–394.

No. 4. May, 1940.

E. Horne Craigie. Vascularity in the Brains of Tailed Amphibians. II. Necturus maculosus Rafinesque. pp. 395–410.

Thomas Hale Ham and William B. Castle. Studies on Destruction of Red Blood Cells. pp. 411–419.

Charles A. Kofoid and Lauren E. Rosenberg. The Neuromotor System of Opisthonecta henneguyi (Fauré-Fremiet). pp. 421–436. 1 pl.

Lauren E. Rosenberg. Conjugation in Opisthonecta henneguyi, a Free Swimming Vorticellid. pp. 437–448. 2 pls.

E. M. East. The Distribution of Self-Sterility in the Flowering Plants. pp. 449–518.

No. 5. June, 1940.

Centenary Celebration of the Wilkes Exploring Expedition and Symposium on American Polar Exploration.

Edwin G. Conklin. Connection of the American Philosophical Society with our First National Exploring Expedition. pp. 519–541.

James A. G. Rehn. Connection of the Academy of Natural Sciences of Philadelphia with our First National Exploring Expedition. pp. 543–549.

Captain G. S. Bryan. The Purpose, Equipment and Personnel of the Wilkes Expedition. pp. 551–560.

William Herbert Hobbs. The Discovery of Wilkes Land, Antarctica. pp. 561–582.

Commander F. W. Reichelderfer. The Contributions of Wilkes to Terrestrial Magnetism, Gravity and Meteorology. pp. 583–600.

Harley Harris Bartlett. The Reports of the Wilkes Expedition, and the Work of the Specialists in Science. pp. 601–705.

Mary E. Cooley. The Exploring Expedition in the Pacific. pp. 707–719.

J. Edward Hoffmeister. James Dwight Dana's Studies of Volcanoes and of Coral Islands. pp. 721–732.

Henry W. Fowler. The Fishes Obtained by the Wilkes Expedition, 1838–1842. pp. 733–800.

Captain Harold E. Saunders. The Flight of Admiral Byrd to the South Pole and the Exploration of Marie Byrd Land. pp. 801–820.

William Lyon Phelps. More Notes on Shakespeare. pp. 493–502.
M. B. Emeneau. A Classical Indian Folk-Tale as a Reported Modern Event: The Brahman and the Mongoose. pp. 503–513.

No. 4. September, 1940.
Symposium: Characteristics of American Culture and its Place in General Culture.
Frederick P. Keppel. Remarks. pp. 515–516.
Frederick Lewis Allen. Today. pp. 517–526.
Alfred V. Kidder. Looking Backward. pp. 527–537.
Lewis Mumford. Looking Forward. pp. 539–547.
Van Wyck Brooks. Discussion. pp. 549–554.
General Discussion. pp. 555–558.
Francis H. Taylor. The Fine Arts. pp. 559–567.
Otto Luening. Music. pp. 569–572.
Arthur H. Compton. Science Shaping American Culture. pp. 573–582.
General Discussion. pp. 583–588.

No. 5. October, 1940.
Elsie Lincoln. Growth in Aeshna tuberculifera (Odonata). pp. 589–605.
Roberts Rugh and Frank Exner. Developmental Effects Resulting from Exposure to X-Rays. II. Development of Leopard Frog Eggs Activated by Bullfrog Sperm. pp. 607–619. 2 pls.
Curtis L. Newcombe. Studies on the Phosphorus Content of the Estuarine Waters of Chesapeake Bay. pp. 621–630.
Gregory Pincus and Herbert Shapiro. The Comparative Behavior of Mammalian Eggs *in Vivo* and *in Vitro*. VII. Further Studies on the Activation of Rabbit Eggs. pp. 631–647. 3 pls.
George Gaylord Simpson. Review of the Mammal-Bearing Tertiary of South America. pp. 649–709.
Fred L. Whipple. Photographic Meteor Studies. III. The Taurid Shower. pp. 711–745.

MEMOIRS:
Volume XIV. June, 1940.
Albert T. Volwiler, editor. The Correspondence Between Benjamin Harrison and James G. Blaine, 1882–1893. 314 pp. 8 pls.
Volume XV. September, 1940.
John U. Nef. Industry and Government in France and England, 1540–1640. 162 pp.
Volume XVI. December, 1940.
William Wallace Newby. The Embryology of the Echiuroid Worm, Urechis caupo. 219 pp. 85 figs.

YEAR BOOK for 1939. 494 pp. April, 1940.

LIST OF PAPERS AND BOOKS IN THE SOCIETY'S PUBLICATIONS CLASSIFIED ACCORDING TO SUBJECT. 173 pp. November, 1940.

COST[1] OF PUBLICATIONS DURING 1940

TRANSACTIONS,				
Vol. 28, Part 3.	92 pp., 2 pls.	$ 606.47		
Part 4.	384 pp., 44 pls.	2,191.95		
Vol. 31, Part 3.	88 pp.	304.68[2]		
Part 4.	47 pp., 10 pls., 7 maps	420.55		
			$ 3,523.65	
PROCEEDINGS,				
Vol. 82, No. 1.	102 pp.	479.63		
No. 2.	123 pp.	574.33		
No. 3.	168 pp.	952.23		
No. 4.	124 pp., 3 pls.	636.73		
No. 5.	429 pp., 4 pls., 1 map	2,056.30		
Vol. 83, No. 1.	215 pp., 6 pls.	1,362.84		
No. 2.	229 pp., 13 pls.	1,348.02		
No. 3.	67 pp., 4 pls.	426.47		
No. 4.	74 pp.	374.82		
No. 5.	160 pp., 5 pls.	928.95		
			$ 9,140.32	
MEMOIRS (bound)				
Vol. 14.	314 pp., 8 pls.	1,314.58		
Vol. 15.	162 pp.	735.21		
Vol. 16.	219 pp.	982.16		
			$ 3,031.95	
YEAR BOOK for 1939.	494 pp. (bound)		2,191.03	
CLASSIFIED LIST OF PUBLICATIONS.	173 pp.		1,088.04	
Total			$18,974.99	

[1] Includes all expenses connected with publication, viz. printing, engraving, wrapping, addressing, mailing, postage, etc.

[2] Total cost of Vol. 31, Pt. 3, was $604.68; $300 paid by the Woods Hole Oceanographic Institution.

Progress has been made in advertising the publications of the Society during the year. Announcements concerning new publications were sent to at least two thousand institutions, libraries and individuals. In addition to this, advertisements of the Society's recent publications have been placed in a few scientific and historical journals and copies have been sent for review to a number of appropriate journals. Receipts from the sale of publications during 1940 amounted to $3,002.32, whereas in 1939 the income was $1,894.95. The cost of direct advertising this year was approximately $470 or about fifteen per cent of the gross receipts.

5. REPORT OF THE COMMITTEE ON RESEARCH

The Laws (Chap. V, Art. 4) specify that the Committee on Research shall consist of the President, *ex officio*, and of not fewer than six other members, representative of the four Classes, who shall serve for three years and who shall be nominated by the President and elected by the Council. In practice it has been found desirable to have more than six elected members in order to obtain wider representation of subjects. While regular election to the Committee is for a term of three years, several persons so elected have found it necessary to resign and others have been appointed to fill out their terms. There is no provision in the Laws against the reelection of a person to serve on this Committee.

The members of the Committee for 1940–41, the subjects they represent and the dates of their last election are listed herewith:

Albright, William F. (Archaeology), 1939.
Bronk, Detlev W. (Biophysics and Physiology), 1939.
Cheyney, Edward P. (Modern History), 1938.
Chinard, Gilbert (Languages and History), 1938.
Conklin, Edwin G., *Chairman* (Biology), 1939.
Miller, John A. (Astronomy), 1939.
Richards, Alfred N. (Physiology and Medicine), 1939.
Shapley, Harlow (Astronomy), 1939.
Sinnott, Edmund W. (Botany), 1940.
Swann, W. F. G. (Physics), 1939.
Taylor, Hugh S. (Chemistry), 1939.
Morris, Roland S., *President, ex officio* (Jurisprudence and Administration).

There are three research funds in the keeping of the Society, the Penrose Fund which is unrestricted, the Johnson Fund which is partially restricted in that it has been agreed that persons working in certain institutions may be regarded as occupying a preferred position, and the Daland Fund which is restricted to research in clinical medicine and one institution has, for the time being, been given a preferred position.

This Committee has been charged with the distribution of research grants from all three of these funds and the same forms of application and methods of procedure are used in all cases.

The Committee held five meetings during the year 1940, namely, on February 9, April 12, June 7, October 11, and December 13.

Applications and supporting letters are manifolded and sent to the members of the Committee about ten days in advance of the meeting; in many cases members consult by correspondence or in person with applicants, or with persons conversant with the applicants or their projects. This work requires considerable time and labor and it has been done faithfully and without compensation.

On February 19 and 20, 1937, a meeting of some thirty-five foundations, universities and other organizations engaged in administering funds in aid of research was held in the Hall of the American Philosophical Society. Two sessions were occupied with round table discussions of methods and results of grants-in-aid of research; an evening address was given by Frederick P. Keppel on "The Responsibility of Endowments in the Promotion of Knowledge;" and a final session considered the most important methods of promoting research as viewed by representatives of (1) research foundations and institutions, (2) learned societies, academies and councils, (3) universities, and (4) research workers and recipients of grants.[1] All participants agreed that this meeting was very helpful and it was suggested that further meetings be held in the future.

The great foundations and universities have methods of promoting research which differ more or less from those which must be employed by learned societies, academies and councils. Representatives of this last named type of organization have felt that it would be useful to exchange information with regard to such matters as the following:

1. Fields covered by each research committee.
2. Times of committee meetings and of awarding grants.
3. Sums usually available each year for grants.
4. Maximum and average size of individual grants.
5. Purposes for which grants may or may not be made, *e.g.*:
    a. Living expenses of applicant.
    b. Assistants of Ph.D., M.A. or B.A. grade.
    c. Equipment of enduring value to be regarded as a gift or loan.
    d. Purchase of standard equipment.
    e. Consumable equipment, materials, supplies.
    f. Travel and field work.
    g. Preparation of manuscripts, drawings, etc.
    h. Subsidy for publication.

[1] These addresses and discussions were published in the Proc. Amer. Philos. Soc. 77: 561–620.

6. Are applicants expected to itemize proposed expenditures?
7. Methods of securing information concerning applicants and projects.
8. Are grants usually paid in full or in installments?
9. Are recipients expected to report expenditures at stated times?
10. Are they expected to furnish abstracts of work completed under a grant?
11. Are they expected to acknowledge aid of grant in resulting publications, and to send reprints or copies of such publications to the grantor?
12. What other methods, if any, are used in following up the results of a grant?

On December 29, 1940, representatives of the Permanent Science Fund and the Rumford Fund of the American Academy of Arts and Sciences, the American Council of Learned Societies, the American Association for the Advancement of Science, the American Philosophical Society, the Geological Society of America, the National Academy of Sciences, the National Research Council, the National Science Fund Committee, the Sigma Xi Research Fund and the Social Science Research Council met in the Hall of the American Philosophical Society and compared methods of awarding grants and of following up the results as indicated in the items listed above.

THE PENROSE FUND

The budget for 1940 assigned $50,000 from the income of the Penrose Fund for the support of research during the calendar year. This is the same amount that has been provided in the budget each year since 1936, but each year it has been necessary for the Committee to ask the Council and the Society for additional sums in order to meet the increasing pressure of worthy applications. Each year from 1936 to 1939, $25,000 was added to the $50,000 budgeted for research. In view of declining income from investments the Committee tried to keep within the $50,000 allowed by the budget during 1940, but at the Autumn General Meeting in November an additional appropriation of $15,000 was recommended. A balance of $508.66 was carried over from 1939 and added to the 1940 appropriation and refunds amounting to $4,912.82 were made, so that a total amount of $70,421.48 was available for grants during the year 1940. The following 107 grants were awarded of a total sum of $60,751.25 leaving a balance of $9,670.23 to be carried over

to the 1941 budget; however, during the year a number of conditional grants were made and, in several instances, the conditions have not as yet been fulfilled:

Grant No. 393. Dwight Clark Carpenter, New York State Experiment Station, for apparatus in connection with the investigation of the effect of light on proteins and amino acids. (Second grant.) ... $ 400

Grant No. 394. Merritt Lyndon Fernald, Harvard University, toward the payment of a technical assistant, expenses of car and motor boat, travel, apparatus, etc., in connection with the studies of estuarine, marsh and sand-plain floras of eastern Virginia and North Carolina. (Second grant.) 500

Grant No. 395. Ronald L. Ives, Boulder, Colorado, for field and office work in connection with a detailed study of glaciation and related phenomena (meteorology, archaeology) at the headwaters of the Colorado River, Grant County, Colorado. (Third grant.) 300

Grant No. 396. Frank R. Kille, Swarthmore College, for assistance and materials for slides, travel, illustrations, etc., for the study of the seasonal cycle of the gonad in the sea-cucumber (H. parvula) and the bearing of these data on the question of gonad regeneration within self-sterilized posterior halves. 200

Grant No. 397. Harold Fisher Wilson, State Teachers College, Glassboro, N. J., for transportation, expenses and typing to gather material on a projected social history of southern New Jersey since 1790. 200

Grant No. 398. William Campbell Root, Bowdoin College, for technical assistance, photographs and supplies to investigate the use of metals in pre-Columbian America. 500

Grant No. 399. Francis G. Slack and Philip Rudnick, Vanderbilt University, for technical assistance, glass blowing and liquid air to make measurements of the Faraday effect in nickel-sulphate alpha hexahydrate (crystal) at low temperatures. 300

Grant No. 400. Edgar Anderson, Missouri Botanical Garden, for a technical assistant in the preparation of a cytological, taxonomic and genetic monograph of the genus Tripsacum with reference to its allies Zea and Euchlaena. 900

Grant No. 401. Arthur C. Cope, Bryn Mawr College, for technical assistance and materials in connection with the study of the rearrangement of allyl groups in three-carbon systems. (Second grant.) 1,000

Grant No. 402. Alfred E. Hudson, White Plains, N. Y., for expenses and traveling in connection with the study of historical sources and museum collections necessary to supplement and complete the ethnographic field study of the Hazara Mongols of Afghanistan 650

Grant No. 403. Edgar T. Wherry, University of Pennsylvania, for traveling expenses in connection with the preparation of a monograph of the genus Phlox (Polemoniaceae). 500

Grant No. 404. Juan B. Rael, Stanford University, for travel, records, typist, collecting old manuscripts from among the Spanish speaking population of southern Colorado and northern New Mexico, for the study of linguistic material, folk music and folklore. ... 500

Grant No. 405. Harry Shultz Vandiver, University of Texas, for technical assistance in connection with the study of Fermat's last theorem and related topics in the theory of numbers. (Second grant.) 1,500

Grant No. 406. William C. Stadie, University of Pennsylvania, for technical assistance in the investigation of the chemical action of insulin upon the intermediary metabolism of isolated surviving tissue of normal and pathological animals. (Third grant.) ... 750

Grant No. 407. Thomas Hale Ham, Boston City Hospital, for technical assistance in the continuation of the study on the destruction of red blood cells in normal individuals and in patients with hemolytic anemias. (Third grant.) 750

Grant No. 408. Simon Freed, University of Chicago, for a research assistant in connection with the study of the structures of the electric fields about ions in solutions and their relations to chemical thermodynamics. (Second grant.) 800

Grant No. 409. John Edward Dinsmore, American Colony Herbarium, Jerusalem, for expenses in connection with the study of the species of the iris in Palestine and Syria. (Second grant.) 100

Grant No. 410. Carl C. Speidel, University of Virginia, for a projector, films, etc., in connection with the investigations with the aid of cine-photomicrography of the reactions of cells and tissues in living frog tadpoles as the animals are subjected to various experimental conditions. (Second grant.) 250

Grant No. 411. Victor Francis Hess, Fordham University, for equipment and an assistant for the investigation of (*a*) seasonal variations, temperature-effect (air mass) and variations of world-wide character of the cosmic radiation at sea level; and (*b*) studies of latitude effect, seasonal and temperature effects on cosmic radiation studied with a Compton model C-meter on board ship between New York and Valparaiso, S. A. 2,000

Grant No. 412. Norton A. Kent, Boston University, for materials for a special microphotometer to be used in connection with his investigation to obtain quantitative values of the relative intensities and the relative wave-lengths of the components of H_a of hydrogen (and later of deuterium). 500

Grant No. 413. Reginald D. Manwell, Syracuse University, for animals, cages, etc., to continue the investigation of the relationship between the occurrence of the exoerythrocytic schizogony and immunity. (Second grant.) 250

Grant No. 414. Lester W. Strock, Research Institute of the New York State Saratoga Spa, for technical assistance and field work in connection with the investigation of the geochemistry of natural mineral waters. (Second grant.) 1,000

Grant No. 415. Neal A. Weber, University of North Dakota, for travel in connection with (*a*) an ecological study of the ant fauna of the Imatong Mountains, Anglo-Egyptian Sudan, with special reference to altitude and plant zones, and (*b*) a comparison of the habits and behavior of Ethiopian and Neotropical ants. 200

Grant No. 416. Albert K. Weinberg, Institute for Advanced Study, for the preparation of a monograph on the ideology of American nationalism, a study of its doctrines in their historical evolution. 1,500

Grant No. 417. Dean A. Collins, Temple University, for technical assistance, animals, drugs and chemicals in connection with the experimental renal hypertension studies on the elevation of blood pressure resulting from the restoration of renal circulation after periods of complete interruption. 250

Grant No. 418. Walter Landauer, University of Connecticut, for technical assistance in a study of the posterior horn cells of the pelvic spinal plexus in different types of polydactylous fowl, with special reference to the asymmetrical incidence of polydactyly. 800

Grant No. 419. James Ogden Baine, Southwestern College, for travel and expenses in connection with the preparation of metallic derivatives of certain aliphatic and aromatic hydrocarbons—benzyllithium, benzylsodium, benzylpotassium and others. 200

Grant No. 420. Henry N. Andrews, Jr., Washington University, for travel, field equipment and an assistant in the collection of Upper Cretaceous fossil plants from the Frontier Formation of southwestern Wyoming. 250

Grant No. 421. Nelson Vance Russell, Carleton College, for microfilming the Cass manuscripts in preparation of a biography of Lewis Cass. 350

Grant No. 422. Nevin Stewart Scrimshaw, Harvard University, for travel and field trips in connection with (1) the study of the factors controlling the reproductive cycle in Poeciliid fishes, (2) the study of the physiology of viviparity, and (3) further observations on the normal embryology of Poeciliid fishes. 400

Grant No. 423. Leon Churney and Floyd Moser, University of Pennsylvania, to defray the expenses of inserting a color plate in *Physiological Zoology*. 93.75

Grant No. 424. Carleton Stevens Coon, Harvard University, to complete the excavation of the cave of Mugharet el 'Aliya, in the international zone of Morocco, and to excavate neighboring sites. 1,000[1]

Grant No. 425. Karl Sax, Harvard University, for a technical assistant in an analysis of x-ray effects on chromosome structure and behavior. (Second grant.) 500

Grant No. 426. Louis W. Chappell, West Virginia University, for field work and travel for the collection and preservation of folk-lore in West Virginia and all types of folk traditions in oral circulation in the state. (Second grant.) 400

[1] Grant relinquished.

Grant No. 427. Arthur H. Compton, University of Chicago, for equipment for airplane and balloon experiments to photograph and study the tracks of cosmic-ray particles at high altitudes. (Second grant.) 1,500

Grant No. 428. Emil W. Haury, University of Arizona, for travel, labor and field supplies for the continuation of the excavation of a pre-Spanish village site on Forestdale Creek in the Fort Apache Indian Reservation, Arizona. (Second grant.) 500

Grant No. 429. Daniel T. MacDougal, Carmel, California, for technical assistance, equipment, and travel in connection with the investigation of the causes of disjunctive growth activity of roots and shoots, especially trees. 1,000

Grant No. 430. Malcolm F. Farley, Chicago, for stenographic assistance, travel and expenses while preparing for publication a study of the history of Fukien and the South China coast. (Second grant.) 500

Grant No. 431. Harrison F. Flippin, Philadelphia General Hospital, for the maintenance of a full time medical resident for a clinical investigation of therapeutic agents in the treatment of pneumonia. 500

Grant No. 432. Willem J. Luyten, University of Minnesota, for student-assistants to measure the stars in connection with the analysis of the distribution of stellar motions in the southern hemisphere; in particular in the zone between declinations $-40°$ and $-52°$ where comparisons for the brighter stars are available through the results obtained at the Cape Observatory. 500

Grant No. 433. Wolfgang Hallgarten, University of California, for one year of studies of the changes in the ideological and socio-economic structure of imperialism 1870–1940. 1,000

Grant No. 434. James A. Beattie, Massachusetts Institute of Technology, for material for a cryostat to be used in connection with an experimental study of the absolute temperature scale from $-270°$ to $+450°$ C. 250

Grant No. 435. B. Edwin Blaisdell, Massachusetts Institute of Technology, for a technical assistant in the numerical integration of Laplace's differential equation for the equilibrium of a fluid drop of axial symmetry. (Second grant.) 250

Grant No. 436. Edward P. Churchill, University of South Dakota, for travel, field work and assistance, in connection with the identification and description of a study of the migrations and the zoeal stages of the edible crab, Callinectes sapidus, which forms the basis of the important crabbing industry of the Chesapeake Bay. 500

Grant No. 437. Malcolm Dole, Northwestern University, for a research assistant for the construction of a Nier-type mass spectrograph. (Second grant.) 200

Grant No. 438. Friedrich W. Lenz, Yale University, for technical assistance, publication, photostats, etc., for the completion of a study of the scholia (or ancient commentary) upon the orations of Aelius Aristeides, the second century sophist. 500

Grant No. 439. John Alvin Pierce, Harvard University, for travel in connection with the determination of the rates of recombination and diffusion of free electrons in the upper atmosphere. 750

Grant No. 440. Herbert Shapiro, Vassar College, for animals, food, cages, etc., in connection with studies on the physiology of development. 600

Grant No. 441. Peter van de Kamp, Swarthmore College, for technical assistance in the measurement of double stars on photographs taken with the 24-inch Sproul refractor, using coarse objective gratings for the compensation of magnitude equation; the derivation of double star orbits with special attention to these measurements. (Second grant.) 1,000

Grant No. 442. Vernon I. Cheadle, Rhode Island State College, for assistance and materials for the investigation of the problem which concerns the conductive system in the Monocotyledoneae, more particularly the conductive elements of the xylem. 400

Grant No. 443. Lawrence Martin, Library of Congress, for technical assistants, field work and travel for the completion, verification and illustration of a manuscript on the discovery of Antarctica by Captain Nathaniel Brown Palmer, 1819–31. 600

Grant No. 444. Guy S. Lowman, Jr., Linguistic Atlas, Brown University, for travel in connection with the study of the linguistic geography of the western Pennsylvania culture area. 1,000

Grant No. 445. Joseph S. Butts, Oregon State College, for technical assistance and chemicals for the study of the metabolism of various amino acids in relation to their conversion to carbohydrate. 300

Grant No. 446. Edward F. Castetter, University of New Mexico, for travel, interpreters and informants for an investigation of aboriginal Indian agriculture in the American Southwest. 750

Grant No. 447. John H. Davis, Jr., Southwestern College, for travel, apparatus and technical assistance for the completion of work on insular changes among the Florida Keys due to mangrove and strand vegetation. (Third grant.) 237.50

Grant No. 448. E. A. Fath, Carleton College, for express charges, batteries and travel in connection with a photometric study of the variable star 12 Lacertae with a photo-electric photometer. 150

Grant No. 449. Charles A. Kraus, Brown University, for a technical assistant in connection with the investigation of the properties of solutions of electrolytes in solvents of lower dielectric constant, particularly at high concentrations. .... 600[1]

Grant No. 450. William Berryman Scott, Princeton University, for an artist and travel in connection with the preparation of a complete monograph of the fossil mammals of the upper Eocene and lowest Oligocene (Uinta and Duchesne River stages). (Fourth grant.) 1,500

Grant No. 451. Ruth Bunzel, Columbia University, for expenses during the time necessary for the completion of a study of the individual in Zuni society. 500

[1] Grant relinquished.

Grant No. 452. Homer G. Barnett, University of Oregon, for travel, interpreters, etc., to analyze the factors and the processes involved in the change of a people's beliefs, customs, and mode of living as such changes are induced by contact with another people with a different culture; the dynamic effects of the impact of our western culture upon that of the Tsimshian tribe of Indians in northern British Columbia. 200

Grant No. 453. William Berrien, Northwestern University, for traveling expenses to and in Brazil to secure material not available in this country and to make studies of linguistic problems and regional customs in connection with the history of the Brazilian novel. 750

Grant No. 454. Robert Gaunt, New York University, for technical assistance and supplies in connection with studies on steroid and pituitary hormones. (Third grant.) 400

Grant No. 455. Carl C. Lindegren, University of Southern California, for technical assistants to analyze bacteria genetically with a view to listing the different genes and describing their various effects. (Third grant.) 500

Grant No. 456. Edgar H. Sturtevant, Yale University, for a research assistant for an analytical collection of the available linguistic materials for the "decipherment" of the Etruscan language. ... 600

Grant No. 457. Roy Philip Forster, Dartmouth College, for the purchase of animals, chemicals, etc., for a comparison of renal function in fresh-water fish and amphibians with that in marine fish. .. 100

Grant No. 458. Fritz Zwicky, California Institute of Technology, for technical assistance, transport of telescope and equipment to investigate extended celestial objects of low surface brightness. 500

Grant No. 459. Kenneth Rossman, University of Iowa, for traveling expenses for the preparation of a biography of Thomas Mifflin (1744–1800). 150

Grant No. 460. Louis D. Goodfellow, Northwestern University, for materials, clerical help and statistical assistance for a statistical technique for controlling the effects of certain subjective factors on psychological data. 360

Grant No. 461. Artheme A. Dutilly, Catholic University of America, for field work expenses, travel, purchase of material, etc., to complete collections of specimens of Arctic flora in North America. 600

Grant No. 462. James Bunyan, Johns Hopkins University, for the preparation of a third volume of a documentary history of the Russian Revolution, to be entitled "Intervention, Civil War and Communism in Russia, 1919." 900

Grant No. 463. J. Bennett Nolan, Reading, Pa., for secretarial work, etc., in connection with the copying of a play "Benjamin Franklin" written and acted by the Irish-American actor, John Brougham, in New York and Philadelphia in 1846 and the years immediately following, with an account of Brougham's connection

with the play, its reception, criticism of the press, etc. (Second grant.) 100

Grant No. 464. Charles G. Osgood, Princeton University, for typing, etc., for the completion of the second volume of "The Variorum Edition of Edmund Spenser's Works." 400

Grant No. 465. Alexander N. Vyssotsky, University of Virginia, for the translator's fee in translating and editing the astronomical sections of the Chronicles of the Russian Monasteries from the 13th to the 17th centuries. 100

Grant No. 466. Benjamin D. Meritt, Institute for Advanced Study, for apparatus, chemicals and technical assistance for the chemical treatment of a collection of about 20,000 paper impressions of Greek inscriptions now housed at the Institute for Advanced Study. 500

Grant No. 467. Hans J. Morgenthau, University of Kansas City, for travel, clerical and scientific assistance in the investigation of the relationship between the political philosophy of liberalism and the basic ideas of pre- and post-World War foreign policy. 460

Grant No. 468. David S. Pankratz, University of Mississippi, for opossums, food, films and technical help in the study of the development and behavior of the pouch opossum as correlated with development of the nervous system. 250

Grant No. 469. Rudolf Altschul, University of Saskatchewan, for travel, materials, brains of monkeys, etc., in connection with the study of (*a*) the distribution and topography of the tortuous vessels in the brain, their individual variations and possible connection with brain diseases, especially with bleeding and softening; and (*b*) the distribution of lipofuscin in human brains especially in the basal ganglia. 300

Grant No. 470. Elsie Murray, Athens, Pa., for field work, travel, technical assistance and photographs in the preparation of an account of Azilum, French refugee colony of 1793–1803 on the upper Susquehanna and of the land company backing it. 800

Grant No. 471. E. A. Speiser, University of Pennsylvania, for an assistant, Dr. Herbert Liebesny, to make an investigation of the system of legal procedure in the Nuzi Documents. 600

Grant No. 472. O. Struve, C. T. Elvey and H. Babcock, McDonald Observatory, for equipment and housing of equipment in connection with the investigation of the applicability of television methods to astronomy and a study of the solar corona with the coronaviser designed and built by Dr. Skellett. 1,000

Grant No. 473. Dorothy W. Weeks, Wilson College, for a research assistant in the studies of the spectrum of the iron arc. 1,000

Grant No. 474. Rudolf Höber, University of Pennsylvania, for a technical assistant in the continued study of the influence of polar and non-polar groups in the molecule of organic compounds; upon membrane potentials of muscles and nerves; and upon the activity

of the secretory and the reticulo-endothelia cells of the liver and of the secretory epithelia of the kidney. (Sixth grant.) 900

Grant No. 475. Arthur Charles Giese, Stanford University, for technical assistance in preparing materials in connection with the investigation of the effect of ultraviolet radiation on respiration of cells. 500

Grant No. 476. David Harker, Johns Hopkins University, for a technical assistant, equipment, etc., for the determination of the structure of native protein molecules and of certain other organic molecules whose structure may throw light thereon by means of x-ray techniques. 1,000

Grant No. 477. Gordon N. Ray, Harvard University, for travel and photostats for a definitive and authorized edition of "The Collected Letters of William Makepeace Thackeray" for publication by the Harvard University Press. 500

Grant No. 478. Richard C. de Bodo, New York University College of Medicine, for animals, chemical materials and technical assistance in the analysis of the antidiuretic action of some drugs (hypnotics) to determine whether the neuropophysis is essential for their antidiuretic action. (Second grant.) 750

Grant No. 479. M. Bruce Fisher, Rhode Island State College, for assistants, apparatus, etc., to study the relation between the critical fusion frequency of flicker at the *fovea* of the human eye and the size, position and brightness of the surrounding field. (Second grant.) 75

Grant No. 480. Herbert Freundlich, University of Minnesota, for technical assistance in the investigation of the adsorption of strong electrolytes on charcoal with special reference to the Hofmeister series and the conceptions of K. H. Meyer. 1,200

Grant No. 481. William Vogt, Peruvian Guano Administration, for the purchase of a dermatherm for the critical determination of surface temperatures of guano islands off the Peruvian coast in connection with studies of the relation of micro-climates to life histories of individual birds, and to population densities and successes in these bird colonies. 175

Grant No. 482. Samuel Wood Geiser, Southern Methodist University, for secretarial assistance in the preparation of a history of scientific work and exploration in Texas, 1820–1880. 300

Grant No. 483. John Kearsley Mitchell Harrison, Elkins Park, Pa., for travel expenses, etc., necessary to establish the proper contacts with the Governmental authorities in promoting defense projects. 75

Grant No. 484. Kenneth Willard Cooper, Princeton University, for travel, expenses in Panama, field work and equipment for an investigation of the meiotic chromosomes of streblid flies parasitic on bats, with the object of demonstrating the means by which homologous chromosomes of flies are held together, disjoined and segregated. 500

Grant No. 485. *Biological Abstracts*, for emergency financing for the year 1940. (Third grant.) 2,500

Grant No. 486. Richard Courant, New York University, for assistance and travel in connection with the completion of a manuscript of a monograph on the Dirichlet Principle and its applications in theory of functions, conformal mapping and minimal surface theory. 1,200

Grant No. 487. Montague Francis Ashley Montagu, Hahnemann Medical College and Hospital, for the typing of the manuscript and the legends to "The Life and Work of Edward Tyson." (Second grant.) 75

Grant No. 488. Jean Piatt, Edmund Niles Huyck Preserve, Inc., Biological Research Division, for travel, chemicals, and materials in connection with the study of nerve-muscle specificity in transplanted aneurogenic limbs. (Second grant.) 200

Grant No. 489. John Ernst Weaver, University of Nebraska, for travel and technical assistance in connection with the study of the process of destruction, adjustments of grasslands to losses by drought, and the methods and rate of re-establishment. (Third grant.) 600

Grant No. 490. Livingston Welch, Hunter College, for assistants and apparatus for an experimental study of the genetic development of the ability to reason in connection with concepts of varying degrees of abstractness. 500

Grant No. 491. J. Kenneth Donahue, College of Charleston, for reagents, cost of rat colony and apparatus for the investigation of the occurrence of estrogenic substances in the ovaries of marine vertebrates and invertebrates. (Second grant.) 150

Grant No. 492. LaDema Mary Langdon, Goucher College, for a technical assistant and an artist to assist in the preparation of drawings in connection with the investigation of the comparative morphology and taxonomy of the Fagaceae. 400

Grant No. 493. Edith von Porada, Pierpont Morgan Library, for expenses while making a complete catalogue of all those seals in the Pierpont Morgan Library not included in W. H. Ward: "Cylinders and Other Ancient Oriental Seals in the Library of J. P. Morgan." (Second grant.) 800

Grant No. 494. William F. Windle and Howard L. Alt, Northwestern University, for technical assistance, etc., in connection with the study of the normal blood picture in early infancy and some possible factors concerned in producing anemia during the first year of life. 800

Grant No. 495. Francis Harper, Swarthmore, Pa., for travel, field work, etc., while preparing for publication John Bartram's manuscript diary of his journey through the Carolinas, Georgia and Florida and of William Bartram's manuscript report to Dr. John Fothergill on his travels. (Third grant.) 300

Grant No. 496. William Jerome Wilson, Library of Congress, to verify the authenticity of a manuscript in the John Boyd Thacher Collection in the Library of Congress, written about 1503, and having to do with the discovery of the mainland of South America. 250

Grant No. 497. Mary Butler, Media, Pa., for travel and expenses in Guatemala, for the preparation for publication of archaeological material excavated in the province of Alta Verapaz, Guatemala, during the winters of 1938–39 and 1939–40. (Second grant.) .. 300

Grant No. 498. Edward Philpott Mumford, Stanford University, for technical assistance and miscellaneous expenses in connection with the study of faunal distribution with particular reference to oceanic islands. 250

Grant No. 499. Charles Marc Pomerat, University of Alabama, for technical assistance and apparatus for the study of the effect of inhibitors of carbohydrate metabolism on the respiration of the frog's egg. 300

The distribution of these grants to various subjects is shown in the following table:

		Grants	Amount
Class I.	Mathematics	2	$ 2,700
	Astronomy and Astrophysics	5	3,150
	Physics	7	6,300
	Chemistry and Geochemistry	11	7,150
	Engineering	1	75
Class II.	Geology	1	300
	Paleontology	2	1,750
	Geography	1	600
	Zoology	8	2,068.75
	Genetics and Cytology	4	2,300
	Ecology	2	437.50
	Botany	9	5,000
	Anthropology	1	1,000
	Psychology	3	935
	Anatomy	4	1,000
	Physiology	8	4,250
	Biochemistry	1	300
	Pathology and Medicine	4	2,300
Class III.	History, American and Modern	10	5,750
	Political Science	1	460
Class IV.	History, Ancient, Medieval and Cultural	5	1,575
	Archaeology	4	2,100
	Ethnology	4	2,100
	Philology and Languages	4	2,600
	Literature	4	2,050
Miscellaneous.	*Biological Abstracts*	1	2,500
	Total	107	$60,751.25

A summary of the research grants from the Penrose Fund made since the beginning of the Society's research program in midsummer of 1933 is shown in the following table:

SUMMARY OF GRANTS AWARDED FROM THE PENROSE FUND
From July 31, 1933, to December 31, 1940

		Grants	Amount	Refunds	Total
Class I.	Mathematics	4	$ 4,400.00		$ 4,400.00
	Astronomy and Astrophysics	27	28,900.00		28,900.00
	Meteorology	4	2,232.00	$ 21.75	2,210.25
	Physics	60	70,025.00	2,064.66	67,960.34
	Geophysics	3	4,200.00		4,200.00
	Chemistry and Geochemistry	38	34,900.00	1,350.00	33,550.00
	Engineering	1	75.00		75.00
	Total	137	144,732.00	3,436.41	141,295.59
Class II.	Geology	4	1,580.00		1,580.00
	Paleontology	13	8,625.00		8,625.00
	Geography	2	900.00		900.00
	Zoology	50	31,740.75	203.73	31,537.02
	Genetics and Cytology	37	30,795.00	123.60	30,671.40
	Ecology, Limnology, and Oceanography	13	6,762.50		6,762.50
	Botany	29	22,948.00	1,227.00	21,721.00
	Bacteriology	4	2,550.00		2,550.00
	Anthropology	6	13,500.00	2,146.14	11,353.86
	Psychology	10	5,235.00		5,235.00
	Anatomy	13	9,425.00		9,425.00
	Physiology	51	46,215.00		46,215.00
	Biochemistry	2	900.00		900.00
	Pathology and Medicine	11	7,200.00		7,200.00
	Total	244	188,376.25	3,700.47	184,675.78
Class III.	History, American and Modern	19	11,100.00		11,100.00
	Political Science and Government	4	8,310.00	78.31	8,231.69
	Total	23	19,410.00	78.31	19,331.69

SUMMARY OF GRANTS AWARDED FROM THE PENROSE FUND—*Continued*

		Grants	Amount	Refunds	Total
Class IV.	History, Ancient, Medieval, Cultural......	11	5,625.00	100.00	5,525.00
	Archaeology..........	28	37,900.00	4,944.53	32,955.47
	Ethnology..........	12	9,450.00	500.00	8,950.00
	Philology and Languages..........	18	16,700.00	42.27	16,657.73
	Literature..........	13	16,650.00		16,650.00
	Drama..........	2	1,000.00		1,000.00
	Music..........	3	3,250.00		3,250.00
	Pictorial Art..........	1	750.00		750.00
	Architecture..........	2	2,500.00		2,500.00
	Total..........	90	93,825.00	5,586.80	88,238.20
MISCELLANEOUS..........		8	21,550.00	9.45	21,540.55
TOTAL..........		502	467,893.25	12,811.44	455,081.81

Total appropriations July 1933 to December 31, 1940..	$465,000.00	
Refunds and cancelled grants..........	12,811.44	
		$477,811.44
Total grants July 1933 to December 31, 1940..........	467,893.25	
Expenses 1933–36*..........	247.96	
		468,141.21
Balance on hand December 31, 1940..........		9,670.23

* After this date a separate fund was established for research expenses.

In explanation of the inequality of distribution of research funds to the four classes it is pointed out that this distribution is roughly proportional to the number of applications from these classes; furthermore the Committee on Research has always attempted to make the grants to the most worthy applicants without reference to the classes or subjects represented.

The funds at the disposal of the Committee on Research are not sufficient to make long-continuing grants and consequently the policy has been to help start or finish worthy projects rather than to furnish continuing support; in only 70 cases have grants been

renewed for a second time and in only 26 cases for a third. Likewise, it has not been possible to make grants to pay in whole or in part the salaries of members of the staff of any institution, nor in general to pay living expenses of applicants.

In all cases applicants are expected to specify the uses to which the grant will be put. In general each grant has been used for several purposes, but the principal uses may be classified as follows: assistants, technical, artistic, etc., 223 grants; apparatus and materials, 129 grants; travel and field work, 128 grants; living expenses, 15 grants, and publication, 7 grants.

Recipients are notified that in no case is a grant to be regarded as a gift or charity but rather as an investment in men and projects, which investment is expected to yield returns. No doubt there are many returns of a more or less intangible nature such as the personal education of the recipient, but the most tangible result of any grant is the promotion of knowledge through the publication of research. All grantees agree to furnish an abstract of the results of their researches for publication in the YEAR BOOK of the Society. In MISCELLANEA for 1935 and 1936, there were published 25 such abstracts; in the YEAR BOOKS for 1937, 1938 and 1939, 289 abstracts; 117 reports are included in this YEAR BOOK; and 47 full papers resulting from grants have been published in the PROCEEDINGS of the Society, 6 in the TRANSACTIONS and 3 in the MEMOIRS; while 118 reports of researches aided by grants of this Society have been reported at its general meetings. In addition, grantees have reported 272 books and articles published elsewhere which have resulted in whole or in part from grants of this Society. Thus practically all grants, except some of those made during the past year for which there has not been sufficient time to expect published results, are represented in these publications. In general this seems to be a fairly satisfactory return on the investments made in our grants-in-aid of research.

Twelve different members of the Committee on Research reported to the Society their estimates of the value of the researches in the fields with which they were especially familiar, and as one member said of his own field they might be classed as good and not-so-good. This could probably be said of the grants in all the fields. It is difficult to say what proportion of all the researches

could be classed as good, fair or poor, but it is probable that at least three quarters of all would fall in the first two categories. Perhaps this is as good a result as could be expected, considering the fact that the Committee on Research has been inclined to favor applicants who are in small institutions where facilities for research are not good. In all such cases the stimulus to investigator and institution has been an important result. On the whole it may be said that the research program of the American Philosophical Society has been a success and that our investments in men and projects have yielded satisfactory returns.

REPORTS FROM RECIPIENTS OF GRANTS FROM THE PENROSE FUND

(Alphabetically Arranged)

Samuel K. Allison, University of Chicago

Grant No. 303 (1939). Precise measurement of the energies of short range particles produced in nuclear disintegrations.

The main part of the work under this grant was done in the period April 1939–January 1, 1940, and is reported in the Year Book for 1939. In the remaining period January 1–April 1, 1940, the work was considerably extended. In the previous report it was stated that two groups of alpha particles were discovered in the reaction:

$${}^{9}_{4}\mathrm{Be} + {}^{2}_{1}\mathrm{D} \rightarrow {}^{7}_{3}\mathrm{Li} + {}^{4}_{2}\mathrm{He} + \mathrm{Q}.$$

Studies of these groups have been made and published, and the reaction energy when the ${}^{7}_{3}\mathrm{Li}$ is left in the normal state has been determined. It can be shown that the Q, or energy release, of the reaction can be predicted from Q's for other reactions studied in this laboratory with the aid of grants from the American Philosophical Society. The predicted value is 7.04 ± 0.06 Mev. The direct measurement gave 7.09 ± 0.02 Mev, which is a satisfactory check of the internal consistency of our measurements. The separation of the two groups of alpha particles was found to be such that an excited state of the ${}^{7}_{3}\mathrm{Li}$ nucleus at 0.494 Mev energy above the normal state is sometimes found in the reaction. The experiments furnished an important contribution to our knowledge of this interesting level in one of the simplest nuclei, where there is some hope of an early theoretical interpretation.

Allison, S. K., 1940. Report of Progress, Yr. Bk. Amer. Philos. Soc. for 1939: 162.

Graves, E. R., 1940. Energy Release from Be^{9} (d, α) Li^{7} and the Production of Li^{7*}. Phys. Rev. 57: 855–862.

Edgar Anderson, Missouri Botanical Garden and Washington University, St. Louis

Grant No. 400 (1940). A cytological, taxonomic and genetic monograph of the genus Tripsacum with reference to its allies Zea and Euchlaena.

A review of the taxonomic literature on Tripsacum and Euchlaena was made and the status of the names of species and varieties as applied to specimens in the herbarium of the Missouri Botanical Garden determined. The variations in the species were studied, a tentative list of undescribed forms made, and the distribution mapped.

An experimental Tripsacum garden was established at the Missouri Botanical Garden in which plants collected in the wild are being grown. A full set of Dr. Mangelsdorf's collection was transferred to this garden in the early spring.

Tripsacum was studied and collected in Kansas, Louisiana, and Texas. Tripsacum dactyloides was found to have several forms which are distinct enough to be separated: an Atlantic coastal form ($n=36$); an Alabama and Florida Gulf Coast form ($n=36$); a narrow-leaved form of the Gulf Coast of all the bordering states ($n=?$); a West Texas form ($n=18$); and a Kansas-Texas form ($n=18$ and 36). T. floridanum is distinct and resembles Manisuris in some respects more than it does T. dactyloides. T. lanceolatum flowers late and is distinct as far as can be seen at present.

Dr. Hugh C. Cutler, who collaborated in this work, was in Mexico and Guatemala from September to December. Collections of plants and seeds were made from 38 localities and the seeds have been planted in the greenhouse. In the mountains west of Chilpancingo were numerous colonies of what appear to be either two species of Tripsacum or one species with all sorts of intergrades with corn.

Collections were made between Guadalajara and Colima, Jalisco. Here, as at the other west slope locations, there was found a dactyloides-like Tripsacum and a maize-like type with all intermediates. Some of the plants resemble maize in all respects except in their root habit and inflorescence. The extreme type is called "Maizillo" by the natives.

In Guatemala Tripsacum was found in several places near the capital. Euchlaena was found wild at a point some 80 miles to the south.

In Central and South Mexico and in Guatemala there appear to be three entities: 1. A narrow-leaved dactyloides-like species which falls under Tripsacum latifolium. This occurs throughout this region and was found wherever one of the other types grew. 2. A wide-leaved pilose form much resembling maize. 3. A wide-leaved glabrous form much resembling maize, T. laxum.

All of the Central American material can be relegated to one of these three groups, although there are intermediates and combinations of the three. The genus Tripsacum is complicated by hybridization among the species and by intra- and inter-entity polyploidy.

Whenever possible, collections of the corn of the regions traversed was collected. In some cases there were corns for sale in the markets that could not be found in the field and seeds of these were secured.

At the National Fairs of both Guatemala and Mexico representative ears of the types exhibited were secured.

A week was spent in the study of several corn fields near Chimaltenango.

About 300 varieties of maize of Central Mexico and of Guatemala have been secured and are being photographed and the seeds are being planted in the greenhouse.

Specimens of the plants of maize from Mexico and Guatemala and of the abnormalities frequently found in the fields have been prepared for study.

Nearly all the main entities in Tripsacum and Euchlaena as well as two species of Manisuris, a closely related genus, have been seen in the field, studied, and specimens and plants secured for more complete study. In the field the species lines, so distinct when there are only a scattered few plants in herbaria, disappear and all intergrades and combinations appear of what are good species in the herbarium.

A great many Central American botanists and agricultural workers were met and there has resulted some exchange of material, publications, and of unpublished research, which is eliminating unnecessary duplication.

HENRY N. ANDREWS, Washington University, St. Louis

Grant No. 420 (1940). A study of the flora of the Frontier formation of southwestern Wyoming.

During the last of June and first half of July 1940, collections of fossil plants were made from the Upper Cretaceous Frontier formation. The field work carried on at that time represented a continuation of an investigation started the previous summer. A study of the plant-bearing horizon was made through a distance of about five miles to the north and south of Little Muddy Creek in the vicinity of Cumberland Gap, the latter being located about 16 miles south of the town of Kemmerer, Wyoming.

Particularly well preserved fructifications, fragments of which were discovered the previous summer, were found constantly associated with foliage previously described as Anemia Fremonti Knowlton. Using the nitrocellulose transfer technique, fragments of the pinnae have been removed from the matrix and macerated with strong nitric acid and potassium chlorate. Black globose bodies borne on the secondary branches of the fertile pinnae have proven to be inrolled pinnules and on the under surface of these sporangia have been observed. The sporangia occur as monangial sori and are borne in two rows as in living species of Anemia. The maceration residue yields an abundance of beautifully preserved spores and although they vary considerably in size (from 25 to 47 micra) they possess the characteristic sculpturing of the Schizaeaceae. Although these fructifications have not been found in actual organic connection with Anemia Fremonti there is very little doubt, due to their constant association with and only with the latter, that they are referable to that species.

Spores have also been isolated from the terminal sori (or sporangia?) of Microtaenia paucifolia (Hall) Knowlton and M. variabilis Knowlton. The general morphology of the fertile pinnae and structure of the spores of the former compares very closely with the Jurassic Coniopteris hymenophylloides. Coniopteris is generally accepted as referable to the Cyatheaceae.

A sufficient number of specimens of the fern previously described as Dryopteris coloradensis Knowlton were collected which have made possible an accurate reconstruction of the frond. Its most distinctive feature lies in the successive trichotomous-like

branchings characteristic of Gleichenia. The similarity is so close as to justify transference of the species to the genus Gleichenites; it compares closely with G. Gieseckiana Heer, a widespread Cretaceous fern.

HORACE W. BABCOCK, California Institute of Technology
(Now at McDonald Observatory)

Grant No. 331 (1939). A photometric study of the light of the night sky.

The first report on this investigation was made a year ago. One practical use that has been made of the results has been the choice of ordinary glass in place of ultra-violet transmitting glass that had been under consideration for the correcting plate of the new 48-inch Schmidt telescope now being completed for the Astrophysical Observatory of the California Institute of Technology. Telescopes to be used for nebular photography will reach fainter limiting magnitudes, and in general will yield photographs of better contrast if the ultra-violet light of the night sky is prevented from reaching the photographic plate.

From September 1939, to September 1940, with the omission of April, May, and June, a series of three hour and ten hour exposures on the night sky has been made by J. J. Johnson and the writer with the quartz spectrograph used for the earlier work. These spectrograms were individually calibrated by step-slit exposures on a standard lamp. The spectra have been studied with the aid of microphotometer tracings, and the intensities of $\lambda5577$, the red group at $\lambda6300$ and $\lambda6360$, the D lines, the ultra-violet bands, and the continuous spectrum have been plotted.

The results show annual changes in the intensity of the night sky radiations, and will be available for comparison with sun-spot and other data. For the interval covered, all radiations reached maximum intensity in October or November, 1939. The largest changes are found for the red lines, which varied five-fold in intensity. The green line, $\lambda5577$, varied four-fold, as did the D lines, while the ultra-violet bands changed nearly as much. The intensity curves for the various radiations exhibit some similarity, but with conspicuous minor differences.

BABCOCK, HORACE W., 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 168.

JAMES OGDEN BAINE, Southwestern College

Grant No. 419 (1940). The preparation of metallic derivatives of certain aliphatic and aromatic hydrocarbons: benzyllithium, benzylsodium, benzylpotassium and others.

The three isomers of *n*-butyllithium, as yet unreported in the literature, have been prepared by the dropwise addition of the corresponding butyl chloride to finely divided lithium suspended in low-boiling petroleum ether—instead of the ethyl ether usually employed in preparations of this kind. The yield in the preparation was determined by filtering the resulting solution, under nitrogen, through a sintered glass funnel in a specially designed apparatus. The soluble organolithium compound in the filtrate was hydrolyzed with water and titrated with standard acid. The yields of the four isomeric forms of butyllithium prepared in this manner average as follows: normal—93 per cent; iso—91 per cent; secondary—87 per cent; tertiary—60 per cent. In addition to giving the lowest yield, the formation of *tert*-butyllithium is very erratic unless extreme care is used in preparing the reagents and apparatus.

The relative reactivity of these compounds in effecting hydrogen-metal interconversion (metalation) was studied, using low-boiling petroleum ether, usually a very unfavorable medium for metalations, and the usual ethyl ether. In petroleum ether the order of reactivity was tertiary > secondary > iso > normal. The extent of metalation was determined by converting the dibenzofuryllithium into the corresponding acid by pouring the reaction mixture onto powdered, solid dry-ice, and isolating the resulting acid in the customary manner. The average yields varied from 30 per cent for *tert*-butyllithium, to less than 5 per cent for *n*-butyllithium.

In order to carry out the metalation in other media the petroleum ether solution was distilled almost to dryness and the desired solvent added. The average yields in ethyl ether were: normal—55 per cent; iso—52 per cent; secondary—12 per cent; tertiary—none. It was observed that the *tert*-butyllithium was completely destroyed by reacting with and cleaving the ethyl ether within a few seconds after they were mixed. The same cleavage reaction, to a lesser degree, took place when *sec*-butyllithium was used. It is obviously not possible to establish any series representing order of reactivity in this case since one of the organolithium compounds reacted much

more rapidly with the solvent than with the compound to be metalated. An attempt will be made, however, to utilize this reaction of *tert*-butyllithium with ethyl ether in working out a system for the identification of the various ethers. This further study seems justified since the identification of aliphatic ethers in general is relatively difficult due to the very few reactions which they will undergo.

This study was made with the association of Mr. Fred Moore, under the direction of Professor Henry Gilman at Iowa State College.

BAINE, OGDEN, 1941. The Preparation of the Isomeric Forms of Butyllithium and a Study of their Relative Reactivity in Hydrogen-Metal Interchange. (To be submitted for publication to the Journal of the American Chemical Society.)

J. A. BEARDEN, Johns Hopkins University

Grant No. 369 (1939). Electronic energy levels of solids by x-ray absorption measurements.

The x-ray measurements on the alloy systems, Cu-Ni, Cu-Zn, and Zn-Ni, have been most valuable for the information they have yielded concerning the electronic charge distribution in these systems. In all binary alloys, the band electrons distribute themselves differently around the two constituents of the same alloy. When metals of high and low valence are alloyed, the charge density around atoms of higher valency is decreased somewhat compared to what it would be in the pure metal, and *vice versa* for the lower valence atoms. The extent to which the component atoms of an alloy are ionized is the prime factor in determining magnetic properties, conductivities, energies of superlattice formation, melting points, lattice expansions, diffusion rates, etc.

The physical properties mentioned above have received two conflicting theoretical treatments. To explain the older magnetic measurements, it has been necessary to assume complete sharing of band electrons. On the other hand, to explain all the remaining properties, an incomplete sharing must be assumed. The x-ray data in the case of brasses have yielded direct quantitative evidence in favor of the latter theory. Accordingly Zn loses 0.1 electron per atom when completely surrounded by copper. This result when applied to observations of conductivities of dilute solid solutions gives excellent agreement between theory and experiment.

The x-ray data on Zn-Ni have indicated a similar incomplete sharing and make possible an immediate understanding of modern data on paramagnetic susceptibilities of these alloys. The Cu-Ni data, in a like manner, have cleared up seemingly unexplainable results on specific heats at low temperatures. As a result of the x-ray work, the evidence in favor of incomplete sharing is so conclusive that it seems urgent to repeat the older magnetic measurements. If newer magnetic measurements yield results in agreement with our x-ray data, the entire problem of the theory of the properties of binary alloys will have reached a unified and coherent state.

Liquids and gases as well as solids exhibit complex absorption edges. For the case of certain gases it is possible to predict from fundamental considerations the fine structure, taking into account the atomic force fields and the finite atomic separations in the molecule. Accurate measurements have been made on both bromine gas and hydrogen bromide. The calculated fine structure for bromine gas fitted well with the experimental findings, giving considerable support to the theory. The force-field used for the calculations on bromine was also used to calculate the angular dependence of electron scattering in bromine gas. The predicted scattering agreed satisfactorily with previous experimental measurements.

The papers on alloys already published deal with alloys whose components differ by only one or two in atomic number. Work is being continued on the binary alloy systems Al-Ni and Al-Cu and some interesting ternary alloys. The newer work will yield information about the band structure of alloys of elements differing widely in atomic numbers. Absorption and emission measurements are also being made on chemical compounds of the iron group elements. These investigations may be expected to add considerably to our present knowledge of the nature of the binding and of the electronic energy levels of these various insulating and semi-conducting compounds.

BEARDEN, J. A., 1940 (with BEEMAN, W. W.). The K Absorption Edges and $K_{\beta_{2,5}}$ Emission Lines of Two Zinc-Nickel Alloys. Phys. Rev. 57: 1085; 58: 396.

—— 1940 (with FRIEDMAN, H.). The Structure of the X-ray $K_{\beta_{2,5}}$ Lines of Copper and Zinc in Brasses. Phys. Rev. 57: 1085; 58: 387.

—— 1940 (with SNYDER, T. M.). The L X-ray Transitions Involving the Conduction Bands of Tungsten and Platinum. Phys. Rev. 57: 1085.

—— 1941 (with SNYDER, T. M.). X-Ray Spectra Arising from the Valence Band—L Transitions of Tungsten, Tungsten Oxide, and Platinum. Phys. Rev. 59, 2: 162.

BEEMAN, W. W., 1939 (with FRIEDMAN, H.). The X-ray K Absorption Edges of the Elements Fe (26) to Ge (32). Phys. Rev. 56: 392.

FRIEDMAN, H., 1940 (with BEEMAN, W. W.). Copper and Nickel X-ray K_{β_5} and K_{β_2} Emission Lines and K Absorption Limits in Cu-Ni Alloys. Phys. Rev. 58: 400.

SHAW, C. H., 1940. The K Absorption Edges of Br (35) and Kr (36). Phys. Rev. 57: 87.

—— 1940 (with SNYDER, T. M.). The Fine Structure of the X-ray Absorption Limits of Bromine and Chlorine. Phys. Rev. 57: 881.

—— 1940. Electron Scattering in Bromine Gas. Phys. Rev. 57: 1085 A; 58: 600.

RALPH A. BEEBE, Amherst College

Grant No. 301 (1939). Heats of adsorption of gases on iron synthetic ammonia catalysts.

There is evidence from simple adsorption measurements that an iron catalyst promoted by K_2O contains a surprisingly high percentage of the latter in its surface. The measurement of the heats of adsorption of gases provides a useful tool for the analysis of the nature of such a surface because it is possible by means of these heat measurements to tell whether a given gas is held to the surface by chemical bonds or by weaker van der Waals forces only.

Continuing the preliminary measurements supported by a part of a previous grant from the Penrose Fund (Grant No. 119), the heats of adsorption on a promoted iron catalyst and an unpromoted catalyst have been measured for CO at 0°, —78°, and —183° C., for CO_2 at 0° and —78° C., and for H_2, A, N_2 and O_2 at —183° C.

On the unpromoted catalyst, heats for the initial and later increments of carbon dioxide added to the surface were low, indicating that van der Waals forces only were operative; but on the promoted catalyst, initial heats were of the order of 25 kcals./mole of gas giving evidence for chemisorption, later increments yielding lower heats due to van der Waals forces. These results may be interpreted on the assumption that chemisorption of CO_2 occurs on the K_2O part of the surface only and that van der Waals adsorption occurs on the iron part of the surface. Carbon monoxide, on the other hand, assumed to be chemisorbed on the iron atoms, gives high heats for those initial increments required to cover the

portion of the surface of the promoted catalyst occupied by iron. These conclusions are in quantitative agreement with those of Emmett and Brunauer based on adsorption measurements without knowledge of the heat changes.

The experiments with oxygen produced very high heats of the order of 100 kcals./mole indicating very strong chemical bonds between the oxygen and the iron atoms of the surface even at —183° C.

Beebe, R. A., 1940 (with Stevens, N. P.). Heats of Adsorption of Gases on Iron Synthetic Ammonia Catalysts at Low Temperatures. Jour. Am. Chem. Soc. 62: 2134–2140.

Thomas Hume Bissonnette, Trinity College, Hartford

Grant No. 384 (1939). Photoperiodicity in animals.

Burger, J. Wendell, 1940. Further Studies on the Relation of the Daily Exposure to Light to the Sexual Activation of the Male Starling (Sturnus vulgaris). J. Exp. Zool. 84: 351–361.

—— 1941. On the Relation of Day-length to the Period of Refractoriness to Photoperiodic Sexual Stimulation in the Male Starling. (Accepted for publication.)

—— 1941. Experimental Modification of the Plumage Cycle of the Male European Starling (Sturnus vulgaris). (Accepted for publication.)

Studies were continued of the photic conditions of the external environment which affect the annual sexual cycle of the male starling. Experiments covering the whole annual sexual cycle were performed. On the progressive phase of the cycle it was found that complete spermatogenesis was obtained only when the individual day-lengths reach a minimum threshold. This threshold was found to be slightly under 12.5 hours of daily exposure to light. It was further found that spermatogenesis occurs at a fairly definite time each year because the natural day-lengths, regularly each year pass this threshold. Sexual activation is not due to any increase, as such, in day-length, but to the attainment of an absolute length of day which is above the threshold. Spermatogenesis can be secured in spite of decreasing day-lengths by 4.5 hours over a month period, provided the decrease does not bring the days below the threshold.

Once an appropriate period of spermatogenesis has occurred the testes involute. Even though long daily exposures to light are maintained, the testes regress to a state of inactivity. They remain

in this state until the following winter. It was found that this refractory state is primarily an inherent one which is largely independent of changes in day-length. Long days (15–16 hours) however, favor the maintenance of this refractory state, while a month's interval of short days (9 hours) followed by long days (15–16 hours) favor the attenuation of this state. In two similar experiments, all birds kept on long days remained sexually quiescent, while one-third of the males, which experienced an interval of short days, showed testicular reactivation when again placed on long days.

In nature, this refractory state acts to check any stimulation by the long summer days. By the time recovery has occurred, the days of autumn are too short to be stimulating. Spermatogenesis then, does not occur until the following spring when the days become adequately long. The annual sexual cycle is controlled by day-length on its progressive side. On the regressive phase, the primarily inherent refractory period is sufficiently long and is supported by natural light conditions so as to make more than one natural breeding period impossible for the male starling.

Another periodic phenomenon of the starling was also investigated. This is the molting cycle. The starling has no obvious sexually dimorphic plumage, and only one molt a year. This takes place during the summer. In two experiments it was found that male starlings which had just passed through an active spermatogenesis could be induced to molt precociously by decreasing the day-length from an existing 15 hours of daily light to 9 hours. Birds kept on long days (15–16 hours) molted several weeks later. In addition, the reduction to short days produced a molt which was completed in about 20 days, while the birds on long days required 45 days and more to complete their refeathering. It seems clear that while molting in the male starling will occur independently of day-length, short days accelerate the process.

BURGER, J. WENDELL, 1941. Some Experiments on the Effects of Hypophysectomy and Pituitary Implantations on the Male Fundulus heteroclitus. (Accepted for publication.)

We have previously shown that the temperature of the water is the major factor in the external environment effecting the annual sexual cycle of Fundulus. Since the endocrine relationships in the reproductive system are imperfectly known in fish, a beginning of

such a study was made. Adult male Fundulus, hypophysectomized shortly after maximal testicular development, show an inhibition of spermatogenesis for stages beyond those of spermatogonial multiplication. Spermatogonial divisions do not progressively accumulate. The inhibition of the later stages is not immediately effected, since a few cysts continue to form sperm for as long as one month after hypophysectomy.

Both hypophysectomized adult male Fundulus and fish which received blank operations were maintained until sexual regression was well established. Intraperitoneal implantations of twenty or fifteen pituitaries from normal male Fundulus caused within two weeks a recrudescence of the testes. Non-implanted controls showed none of this activity. It is concluded that the pituitary of the adult male Fundulus contains gonadotropic material and that the testes of adult Fundulus, hypophysectomized or not, are responsive to this material. The normal relation of the pituitary to the annual sexual cycle is discussed.

BISSONNETTE, T. H., 1940 (with BAILEY, E. E.). Den and Runway System for Weasels and Other Small Mammals in the Laboratory. Amer. Midland Naturalist 24 (3): 761–763.

It was found necessary to invent or adapt some of the cage and den systems in vogue to enable us to keep weasels in the laboratory for long periods for experiments with night-lighting. The dens as now used consist of a wooden box with removable top under which is fastened a false top of half-inch galvanized wire mesh. The den is partly divided into a bed-chamber and hallway by a partition half the height of the inside of the box. The hallway opens by a two-inch hole to a similar hole in the wooden end of the runway, made of half-inch wire mesh and about two feet long or longer as desired. The den and runway are securely held together when in use by a large wire nail passed down through the hole in an eye-bolt fastened to the den and passing through a slot in the wooden end of the runway. To separate the den from the runway for any purpose, the nail is removed after slipping a shingle or sheet of metal between the den and runway, so as to act as a door on the member containing the animal.

These double units are grouped in fives upon the top of four-legged racks or frames which run on large casters. Glass drinking vessels (Geo. H. Wahmann Co., Baltimore) have their lower

horizontal ends shielded by brass tubing with opening in the upper side above that in the glass. This prevents the animals from breaking the glass and swallowing some of the splinters. Dimensions and advantages are given in the paper.

—— 1941. Experimental Modification of Breeding Cycles in Goats. Physiological Zoöl. (In press.)

This was an attempt to see if the long sexually quiescent period of the goat from mid- or late-March until early September could be broken by modifying the daily period of light to which the animals are exposed. It was carried out at Hillshires Farm, Killingly, Connecticut, on animals kindly supplied by Dr. Baldwin, proprietor of the farm.

It has been believed by goat-breeders that the breeding cycle of the goat is controlled by the temperature cycle with the seasons. Our work on animals exhibiting the reverse of the situation found in goats and breeding about the times the goat will not breed, such as ferrets, raccoons and some birds, and that of Hoover and Hubbard [1] with Brook Trout, led us to suspect that the seasonal light-cycle might be a greater factor in the phenomenon than temperature cycles. The obvious advantage to goat breeders of having animals mate throughout the year and drop kids accordingly with distributed crests of milk-production was in mind.

Knowing from the work of others and our own experience that mere reduction of length of day would probably not succeed without an induced antecedent period of rest from sexual activity resulting from long days, we proceeded to increase the daily period of light in late winter and early spring and then decreased it rapidly in later spring and summer. Temperature cycles were not changed from normal, so that the effects of temperature and light cycles could be separated.

The main herd was kept on normal seasonal light cycles and served as controls. Their mating stopped about the middle of March and began again after the first of September, with exact dates for individual animals scattered around those dates. One or two females failed to show mating behavior throughout the normal season for some unknown reason.

Five females of known breeding behavior and a young mature male were used as experimentals. Their daily period of light was

[1] Hoover, E. E., and H. E. Hubbard. Copeia, No. 4: 206-210 (1937).

increased beyond normal daylight, beginning on January 3, by electric-lighting after sundown from a 100-watt bulb so placed that they could not hide their eyes from its rays. This light was turned on by a time switch for periods after night-fall increasing one hour each ten days to seven hours each night on March 27 and for ten days thereafter. It was then reduced by one hour each week from April 5 to normal daylight on May 17 and for one week thereafter. It was then further reduced by driving the animals into the stable one hour before sunset and closing the light-tight blinds on the windows for this added hour of darkness each day. This added time of darkness was increased by one hour each week to six hours per day on June 28 and held at that period until July 6, when the animals were all turned out in a pasture together so that any receptivity of the females might be acted upon by the male without interference.

The experimental females were not observed to be in heat or estrus after February 20 until one showed the twitching of the tail and receptivity characteristic of estrus on May 17. Two others showed similar behavior on May 28 and 29, respectively. The first female was again on heat on June 14 and was mated with the experimental male. He was not very aggressive. The female on heat on May 29 came on again, June 16 and 17, and was tried with the same male. He did not mate although she was receptive. The other two females failed to show heat before July 6, when the male and the experimental females were all turned into a pasture together so that he might take advantage of any heat periods of the females. Experimental light-control was terminated at this date.

None of the above mentioned heat reactions was completely normal and the behavior of the male was not like that of one in the normal mating season. They did demonstrate, however, that the long anoestrous period of the goat during the summer months can be broken by controlled reversal of the light-cycle and that sexual cycles in some females can be induced to recur outside the normal breeding season.

Although none of the females was seen to mate after they were turned out to pasture, four of them, at least, must have done so in July between the 11th and 16th, inclusive. They dropped kids between December 11 and 16 to the number of seven (5♂♂ + 2♀♀). The failure of the other female to produce any kids need not mean she did not mate and, if she did not do so, it is possible that

other causes than failure of the treatment for her may have been responsible. Two of the control females passed a whole season without mating.

While refinements of technique are still to be worked out, the results indicate that sexual or breeding cycles in these goats are controlled in part by the length of daily period of light rather than by temperature cycles. Short days induce or permit estrus or heat; long days inhibit it. Pregnancies and viable kids can be obtained out of season, with normal milk-production, by control of lighting.

—— 1941 (with CSECH, A. G.). Light-induced Egg Production in Large Pens Followed by Normal Nesting in Pheasants. Jour. Wild Life Mgmt. (In press.)

Our previous studies on this problem[1] have been continued and finished with birds and care supplied by the Connecticut State Department of Fisheries and Game, using new methods of housing and larger numbers of birds per cock. The pens were large enough for commercial pheasant-breeding or effective State breeding for restocking areas depleted of game.

As in the previous study, Mongolians (1♂ + 6♀♀), Ring-necks (1♂ + 8♀♀), and Black-necks (1♂ + 5♀♀) were used. In the first experiments Black-necks and Mongolians laid fertile eggs in nests after daily light periods were reduced to normal and cover provided for the birds in April, with good fertility and hatch; but Ring-necks failed to make nests or lay fertile eggs after such reduction of lighting.

In the study here reported, numerous eggs were laid by all three groups from February 13 onward to April 25 as the result of night-lighting added to normal daylight periods, with fair fertility. Some nests were scooped out from the straw on the floors by all three groups during this period and laying continued through severe weather, even when some of the birds had to be broken out of ice in the pens in the mornings and snow was deep in the pens. Laying did, however, slow down during, and for a short time after these severe "spells" of weather. This indicates a minor influence of low temperature and rough weather on laying in these birds, not strong enough to offset the effect of lengthening days to induce sexual activity.

[1] Bissonnette, T. H., and A. G. Csech. Jour. Wild Life Mgmt. 3 (1): 26-30.

On return to normal days and to cover, on April 25, laying slowed and stopped for short times in all groups. As in previous studies, laying was resumed at a slower rate; Ring-necks built two nests and laid in them (none last year) Black-necks, one (one last year), and Mongolians, none (two last year). Fertility was only fair in the eggs in these nests.

Using the results of both years' studies, each group made two nests and laid fertile eggs in them. It is therefore probable that all three varieties of pheasant will lay clutches of fertile eggs and hatch and rear broods in the wild after use for early light-induced egg-production and then released or "planted" in the wild at the normal breeding season. They may produce and rear enough chicks to reach the carrying capacity of the areas in which they are liberated and at no cost for care and keep after liberation.

Studies on sexual photoperiodicity of raccoons have been continued by Bissonnette and Csech. One, two and three females have been used with a single male and 40-watt bulbs instead of 25-watt ones previously used. This was to see if stronger lights or more females per male would modify results.

These indicate that three or even more females may be used to advantage with one male and give two or more pregnancies per pen. One male was able to impregnate four females in one season, with live litters following. Second litters were not produced during this year by any females although several females had done so in previous experiments with less intense light from 25-watt bulbs. The evidence that 40-watt bulbs give light too intense for getting second litters is not conclusive; they did give early litters. Other conditions at the sanctuary were less advantageous than in previous years. It may be concluded that there is no advantage in the stronger bulbs which cost more to burn. One is led to suspect that these more or less nocturnal animals hide their heads from the stronger light more often and for longer times than from the light from the 25-watt bulbs, and that this reduces the effective light-time that they allow themselves.[1]

[1] As the sanctuary in which these experiments were carried out has been closed and the animals removed elsewhere or freed, under the State economy drive, these experiments cannot now be followed up and results will not be published elsewhere *in extenso*.

B. EDWIN BLAISDELL, Massachusetts Institute of Technology

Grant No. 435 (1940). Numerical integration of Laplace's differential equation for the equilibrium meridian of a fluid drop of axial symmetry.

The scope of this work was outlined in last year's progress report. In summary, it is to facilitate accurate mercury manometry by furnishing numerical tables of capillary depression and meniscus volume in terms of the capillary constant as a unit of length; and tables of meniscus shape which permit the determination of the capillary constant of the mercury, as used, from X-ray photographs of the meniscus.

These tables give to five significant figures the capillary depression and meniscus volume as a function of meniscus height and tube diameter; and the slope and radial coordinate of the meridian as a function of the height coordinate and the radius of curvature at the crown.

The tables already prepared and published cover tube diameters from 10 mm. to 20 mm. Receipt of this grant has enabled the completion of the recalculation of the results of Bashforth and Adams, which cover tube diameters from 1.5 mm. to 10 mm., and the extension of the numerical integrations into the range of tube diameters, 20 mm. to 30 mm.

BLAISDELL, B. EDWIN, 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 178–179.

—— 1940. The Physical Properties of Fluid Interfaces of Large Radius of Curvature. I. Integration of Laplace's Equation for the Equilibrium Meridian of a Fluid Drop of Axial Symmetry in a Gravitational Field. Numerical Integration and Tables for Sessile Drops of Moderately Large Size. Jour. Math. Phys. 19: 186–216.

—— 1940. The Physical Properties of Fluid Interfaces of Large Radius of Curvature. II. Numerical Tables for Capillary Depressions and Meniscus Volumes in Moderately Large Tubes. Jour. Math. Phys. 19: 217–227.

—— 1940. The Physical Properties of Interfaces of Large Radius of Curvature. III. Integration of Laplace's Equation for the Equilibrium Meridian of a Fluid Drop of Axial Symmetry in a Gravitational Field. Approximate Analytic Integration for Sessile Drops of Large Size. Jour. Math. Phys. 19: 228–245.

RICHARD C. DE BODO, New York University College of Medicine

Grant No. 360 (1939). Cause and mechanism of the loss of hypersensitivity to insulin and the return of gluconeogenesis to a normal level.

Grant No. 478 (1940). Study of the relationship of the pituitary gland and hypothalamus to carbohydrate and water metabolism, with special reference to (1) an analysis of the antidiuretic action of morphine, and (2) an investigation of the resistance of the hypophysectomized dog to the hyperglycemic effect of adrenaline.

1. The antidiuretic action of morphine has been demonstrated in the following way: When normal dogs in water equilibrium are given water by stomach tube they excrete it practically quantitatively within three hours. When, however, morphine is given subcutaneously 35–40 minutes after the administration of the water (allowing time for the absorption of the water from the stomach before the vomiting due to morphine occurs) the dogs excrete only a small fraction of the administered water. The same results were obtained when the water was administered intravenously following the subcutaneous injection of the morphine.

In an attempt to analyze the mechanism of this antidiuretic action of morphine, these experiments were repeated:

(*a*) on animals with inactivated adrenals (right adrenal removed and left denervated and demedullated)

(*b*) on animals in which the entire neurohypophysis (neural lobe, infundibular stem and median eminence) was destroyed.

In series (*a*) the results did not differ from those obtained in normal animals. It was therefore concluded that the adrenaline—which had been shown by us in previous work to be liberated by the morphine—is not responsible for its antidiuretic action.

In series (*b*) the water administered was excreted quantitatively in spite of the preceding injection of morphine. From this it is concluded that the neurohypophysis is essential for the antidiuretic action of morphine.[1]

2. It has been shown that hypophysectomized dogs while sensitive to insulin are resistant to the hyperglycemic effect of adrenaline though their livers contain fairly large amounts of glycogen. The adrenaline was infused intravenously and the dose given was within physiological limits. The resistance to adrenaline observed

[1] These results were presented before The American Society for Pharmacology and Experimental Therapeutics, at New Orleans, La., March, 1940.

in the hypophysectomized animals seems to be an important factor in their sensitivity to insulin and in their inability to withstand starvation.[1]

de Bodo, R. C., 1940 (with Sweet, J. E.). The Antidiuretic Action of Morphine in Diabetes Insipidus. Jour. Pharmacol. & Exper. Therap., 69, No. 4, August, 1940.

Adam G. Böving, Smithsonian Institution

Grant No. 321 (1939). Morphological investigation of the taxonomically important structures of the larvae of the beetles of the genus Phyllophaga.

In the Year Book for 1939 (pp. 179-181), a general plan of the study was outlined and some preliminary results recorded.

During the second year of the grant, the research has been completed and a manuscript is being prepared for publication.

It has been considered necessary to enlarge the range of the investigation in order to determine the systematic position of the genus in the tribe Melolonthini and especially to find out whether the West Indian beetles hitherto classified as species of Phyllophaga, in reality belong in the genus, or should be separated from it.

The study of the larvae showed them to be so different from the Phyllophaga larvae from the mainland of the American continent that it was impossible to include both in a common diagnosis by which to separate the genus Phyllophaga from the other genera of the tribe. As the adults of the West Indian forms were found to present the same systematic difficulties through recent studies by Mr. Lawrence W. Saylor, U. S. Fish and Wildlife Service (formerly Bureau of Biological Survey), it was decided to create two new genera for them, Cnemarachis, Saylor, and Clemora, Saylor. The result of our work has been given in two separate papers, one dealing with the adults, by Saylor, and one dealing with the larvae, by myself. Both have been accepted for publication in the *Proceedings of the U. S. National Museum* during 1941 and will be printed successively.

The substance of the work on the Phyllophaga larvae, as it will appear in finished form at the end of the current year, may be summed up as follows:

[1] This work has been completed and is being prepared for publication.

The main problem of the investigation centers upon the question of whether in a large genus of beetles, the specific classification of the adults and the larvae will coincide, notwithstanding the fact that the two classifications are based on entirely different structural characters. An intensive study of this problem has never been undertaken before, although the present author, in cooperation with Dr. F. C. Craighead, has shown in their book on the principal larval forms of the Coleoptera, that the classification of the larvae to family and subfamily as a rule agrees with the commonly recognized family—and subfamily—classification of the adults. The present investigation has affirmed the supposition that the classification of the Phyllophaga larvae and that of the adults conform, and that most of the species and particularly the different groups of species are identically determined, whether by adult-characters or by larval characters. However, this result was not obtained before the antiquated arrangement of the groups by Horn, which was based on secondary sexual characters, had been revised by me and a new grouping of the adults created in accordance with the modern idea that above all it should be based on the primary sexual characters.

Comparing the adult and larval classifications, the significant difference was recognized that a progressive development of the species can be followed only in the adults (and there notably by the different formation of the male genitalia). In the larvae, on the other hand, none of the features used as characters in the classification show a continuous development from species to species. But, linked together in various ways, the different combinations of the characters produce diagnoses which separate the species into groups which, as mentioned, conform with the groups of the adults and therefore appear to be natural.

The morphological and systematic phases of the investigation are treated separately. A morphological description of all the external structural details of the larvae in the genus has been prepared to serve as a standard record with which the corresponding body-parts of other genera of Melolonthini can be compared, in order to establish satisfactory generic diagnoses. The structures which vary extensively in form and number in the members of the genus Phyllophaga, but are constant in the single species, are described most fully, because it is from such variations in the morphological parts that the specific characterizations are drawn. A series

of new terms has been worked out for the detailed and precise description of many of the parts.

The taxonomic work, which presents a rather diversified aspect, falls into three different categories. It deals first with the interrelationship of the genera in the Melolonthini and the systematic position of the genus Phyllophaga in the tribe. A synoptic key is given to the known larvae of the genera in the Melolonthini, followed by a diagnosis of the genus Phyllophaga, a key to the larval groups into which the species have been brought together, and a long synoptic key to the 62 known larval species.

In a second part of the taxonomic work, a new grouping of the adults is proposed. This is preceded by a comparative morphological study of the male genital structures and by a much needed terminology for their taxonomically important elements and is followed by a discussion in which the revised grouping of the species is contrasted with the customary current classification by Horn; a table is added to show in a comprehensive way the differences between the two groupings.

In the third and last part of the taxonomic work, the groups of the revised classification are defined by a combination of adult and larval characters, and the part concludes with systematic descriptions of the mature larvae, each description supplemented with taxonomic notes on the corresponding first stage larva (when known) and the genital characters of the imago.

The paper is illustrated with many figures of taxonomically important structures pertaining to the larvae and the male organs. It will appear in the publications of the Smithsonian Institution as soon as the facilities for printing make it possible.

The successful prosecution of this investigation was made possible through grants in 1939 and 1940 from the Penrose Fund of the American Philosophical Society and the National Academy of Sciences.

Böving, Adam G., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 179–181.

—— 1941. Description of the Larvae of Some West Indian Melolonthini and a Key to Larvae of this Tribe of Scarabaeid Beetles. Proc. U. S. Nat. Mus. 90. (To be published.)

—— 1941. The Morphology and Classification of the Larvae of Genus Phyllophaga, with a Proposed New Taxonomic Grouping of the Species of this Genus of Scarabaeid Beetles. Proc. U. S. Nat. Mus. (To be published.)

S. C. Brooks, University of California

Grant No. 376 (1939). Continuation of investigations of the intake and exit of ions in living cells, particularly Nitella, Paramecium and eggs of marine invertebrates.

Previous work here and elsewhere shows that when protoplasm is immersed in a suitable salt containing a radioactive ion these ions enter cells with compensatory loss of similar ions. This process is often very rapid, as shown by Spirogyra which takes up Na^* from Na^*Cl 0.01 M, the protoplasmic concentration reaching 0.15 M within 15 seconds. This is inorganic ion exchange, often called induced accumulation. In contrast with and in addition to this, the same cells actually increase their salt by means of a process known as primary accumulation. In our work we are adopting as a working hypothesis the idea that this primary accumulation involves an ion exchange in which protoplasm gives up metabolically produced organic ions in exchange for the accumulated ions.

With the assistance of Dr. Burris Cunningham we are studying the nature of those waste products which furnish the ions requisite in this exchange, using Paramecium caudatum. First it was necessary to follow the salt absorption following the introduction of these animals into 0.01 M KCl solutions. Improved methods for drop analysis for potassium and sodium were devised by Dr. Cunningham and tested. Using these methods we found that paramecia absorbed most of the potassium provided, little chloride, and released extremely small amounts of sodium. Presumably no other inorganic ions are significant, although tests will be made. During the first period, comprising readings between 0.25 and 3 hours, the changes in potassium concentrations are compatible with changes observed in experiments with other fresh water plants and protozoa. Much of the disproportionately high cation absorption seems to be compensated by NH_4^+ excretion, although other organic ions must also be involved. This is suggested by previous literature, particularly that of Dr. Cunningham. Current work is directed toward characterization of these organic ions. Their very presence and their relation to metabolism are fundamentally important in the general study of primary accumulation in plants and animals.

Cunningham, Burris, 1941 (with Kirk, Paul L., and Brooks, S. C.). Quantitative Drop Analysis. XIII. Potentiometric Determination of Chloride. XIV. Determination of Potassium. Jour. Biol. Chem. (In press.)

LUDVIG GUSTAV BROWMAN, Montana State University

Grant No. 244 (1938). Oestrous and activity rhythms, and reproductive behavior of rats born and kept in constant darkness as contrasted with those kept in constant light.

Rats with both eyes removed at birth weighed consistently less throughout life than did their normal littermates. Young born to bilateral enucleated females weighed less than young from normal-eyed females. Evidence indicated that this weight difference was not due to the operation as such or to lowered food consumption.

Testes of bilateral enucleated males reached a stage in spermatogenesis comparable to the 40-day normal male by about sixty-five days of age. Secretory activity of the seminal vesicles was also delayed in the enucleated animals by approximately three weeks.

The evidence indicates that the removal of the eye retards growth and disturbs gonadal functions because of the relationship of the eye to the anterior lobe of the pituitary. Since rats raised in the dark, bilateral enucleated rats, and rats born microphthalmic all showed a delay in growth and sexual maturity, it is probable that the impact of visible radiation on the eye is necessary for the development of the various phenomena characteristic of normal growth and sexual maturity.

In addition to the paper noted below, of which this report is an abstract, other manuscripts are in the process of preparation, one of which will be sent to the publishers in the near future.

BROWMAN, L. G., 1940. The Effect of Optic Enucleation on the Male Albino Rat. Anat. Rec. 78, 1: 59–77.

F. MARTIN BROWN, Colorado College and Fountain Valley School, Colorado Springs

Grant No. 217 (1938). Investigation into the microscopic structure of mammalian hair for assistance in determining the sources of wools used by the North American Indians.

At present slides representing all of the genera of mammals found north of the Mexican border except the Pinnepedia and Cetacea have been made. Difficulty in procuring cover glasses has temporarily delayed the completion of the slide series.

The manuscript with 128 figures representing the genera of the Carnivora has been completed and is ready for publication. The studies on the Artiodactyla have been completed and the drawings begun. Some drawings and a few measurements have been made in the other families notably the Rodentia and Chiroptera. The manuscript for the Artiodactyla should be completed by May, 1941; for the Rodentia by December of that year and the final section should reach completion by May, 1942.

The work on this grant was interrupted by a year of research in Ecuador shortly after the award was made.

JOHN T. BUCHHOLZ, University of Illinois

Grant No. 337 (1939). Pollen-tube growth in crosses between the tetraploid and diploid plants of ten species of Datura.

Pollen-tube growth in polyploids was investigated in 10 species of Datura—stramonium, quercifolia, ferox, pruinosa, leichhardtii, discolor, ceratacaula, meteloides, metel and innoxia. Each of these species was investigated, (1) with reference to the pollination $4n \times 4n$ compared to the pollination $2n \times 2n$; (2) with reference to the cross-pollination $4n \times 2n$ and $2n \times 4n$ and (3) with reference to the cross-pollination $4n \times 4n$ when made between the ten species and compared to the same combination $2n \times 2n$.

The method used was that of pollinating cut flowers left at a uniform temperature (about 19°C) for periods of 10–24 hours, following a technique which has been described [1] and used previously in a comparison of $2n \times 2n$ interspecific pollinations.[2]

Test flowers were obtained from greenhouse plants, all of which had been examined cytologically. All of them had been inbred for many successive generations, many of them were grafted plants, all belonging to the same clone. They were, therefore, as uniform genetically as it is possible to obtain plants and it would be difficult to select a group of species belonging to the same genus which would be more ideal for such an experiment.

Daturas are species of world-wide distribution and may be found

[1] Buchholz, J. T. Stain. Technol. 6, 1: 13–24 (1931).

[2] Buchholz, J. T., L. F. Williams and A. F. Blakeslee. Proc. Nat. Acad. Sci. 21, 12: 651–656 (1931).

growing together only when under cultivation. The plant cultures used were those assembled and maintained by Dr. A. F. Blakeslee at the Department of Genetics of the Carnegie Institution of Washington at Cold Spring Harbor, Long Island, New York. All of these investigations have been carried out in collaboration with him. The tests were made during several successive summers and the statistical analyses were carried out at the University of Illinois.

The results were measured by means of a comparison of the pollen-tube distributions obtained at selected intervals of 10–24 hours. This time-variation was necessary because of differences in the rates of pollen-tube growth among the ten species and because in the species with the smallest flowers the pistils are only about 30 mm. long, while in the species with the largest flowers the pistils are about 190 mm. long.

The statistical data which are considered to be of the greatest value in a comparison of such tests are the relative number of pollen-tubes which have grown to full length or reasonably long in a given period of time. In any ordinary pollination these may be expected to continue their growth to reach the ovary where they may effect fertilization. The percentage of the total number of observed pollen-tubes that had grown to half the length of the longest and were still normal in appearance was used as a performance index. Means were taken from the performance indices of from seven to a dozen or more individual tests.

Individual tests vary slightly, depending upon the size of the individual pistils, especially the styles and stigmas; they also vary somewhat depending upon the quantity of pollen that was used in making the pollinations. Variations are also dependent upon other physiological factors that are not so easily determined or subject to control.

Since an individual test would employ from 150–1000 or more viable pollen grains, the performance indices were based upon records of 2500–5000 pollen-tubes for each kind of pollination.

1. Tetraploids compared to diploids.

When pollen-tube growth of tetraploid plants was compared with diploids, all of them gave a lower performance index than that found in corresponding diploids. These were as follows:

	Performance Index (%)		
	$2n \times 2n$	$4n \times 4n$	difference
Datura stramonium	74	37	37
discolor	63	26	37
metel	69	37	32
meteloides	71	41	30
innoxia	57	29	28
ceratacaula	66	46	20
leichhardtii	63	43	20
quercifolia	64	50	14
ferox	70	66	4
pruinosa	60	58	2

All of the $4n$ plants actually produce seeds when self-pollinated so that the lowest indices (26% and 29%) may be considered within the limits necessary for successful seed production.

In a few species the decrease of $4n \times 4n$ below $2n \times 2n$ is so small that it may not be considered significant. However, it is apparent on the whole, that doubling the number of chromosomes in plants decreases the efficiency shown in their pollen-tube growth, and that the amount of this decrease differs among species belonging to the same genus.

2. Cross-pollinations between the tetraploids and diploids of the same species.

When pollen-tube growth resulting from the cross-pollinations $4n \times 2n$ was compared with the cross-pollination $2n \times 4n$, the ten species were also found to differ through a wide range. The results obtained follow:

	Performance Index (%)		
	$4n \times 2n$	$2n \times 4n$	difference
Datura meteloides	73	23	50
stramonium	65	17	48
innoxia	44	13	31
leichhardtii	70	44	26
metel	50	30	20
ferox	56	48	8
quercifolia	59	52	7
pruinosa	65	59	6
discolor	34	28	6
ceratacaula	52	48	4

With respect to this set of comparisons the ten species of Datura fall into two groups. In the first five there are differences of between 20 and 50 in the performance indices shown in the reciprocal cross-pollinations among tetraploids and diploids; in the last five these differences are between 4 and 8.

The first five listed show essentially the same relation between reciprocal crosses as was previously described [1] for D. stramonium for which the data remain essentially the same. However, in the last five species on this list there is only a slight difference in pollen-tube growth between reciprocal crosses. In view of the fact that seeds are produced from the self-pollination of tetraploids of D. innoxia and D. discolor, whose indices are much lower (see first table), it is obvious that there are no limitations in pollen-tube growth that should operate to prevent the formation of seeds in the last five species whether the cross is made $4n \times 2n$ or $2n \times 4n$.

In D. stramoninm the practical experience of many years has shown that triploids are easily obtained in the cross $4n \times 2n$ but only very rarely in the cross $2n \times 4n$. In the species ferox, quercifolia, pruinosa, discolor and ceratacaula the cross $4n \times 2n$ is prospectively more favorable than the cross $2n \times 4n$, but should be possible in either combination.

3. Cross-pollinations between tetraploid plants of different species.

While my plans at the time when a grant-in-aid was awarded by the American Philosophical Society included only the study of intra-specific pollinations in these 10 species, this work was unavoidably delayed so that it was found possible to carry out a large number of cross-pollination tests between the tetraploid of the ten different species. Tests of most of the ninety possible $4n \times 4n$ interspecific combinations have been made; of these thirty have thus far been tabulated, and all of these showed decreases in the performance index when compared to the corresponding diploid interspecific pollination.

Among interspecific pollinations between diploid plants [2] a large number gave conditions of pollen-tube growth which indicated that it would be possible to obtain seeds, if any, from only one of a pair of reciprocal pollinations. Usually, however, the best one of the pair of reciprocal pollinations gave an excellent performance index, indicating that failure in the production of interspecific hybrids

[1] Buchholz, J. T., and A. F. Blakeslee. Genetics 14: 538–568 (1929).

[2] Buchholz, J. T., L. F. Williams and A. F. Blakeslee. Proc. Nat. Acad. Sci. 21, 12: 651–656 (1931).

was not due to pollen-tube growth. Where the combinations which gave complete failures in pollen-tube growth were tested in $4n \times 4n$ interspecific cross-pollinations, not a single instance of improvement over the $2n \times 2n$ cross was found. Combinations that were somewhat intermediate in $2n \times 2n$ cross-pollinations, usually gave complete failure in the corresponding $4n \times 4n$ pollinations. The $2n \times 2n$ interspecific combinations that indicated favorable conditions of pollen-tube growth (index above 50) usually gave a very significantly lowered performance index.

Even without the completed data from all possible $4n \times 4n$ interspecific pollinations, the general conclusion is obvious on the basis of the facts at hand, that tetraploidy definitely decreases the crossibility between species.

MILLAR BURROWS and NELSON GLUECK, American Schools of Oriental Research

(Dr. Glueck now at Hebrew Union College)

Grant No. 290 (1939). The completion of the excavation of Tell el-Kheleifeh (biblical Ezion-geber) on the Gulf of Aqabah.

During 1938, 1939, and 1940, expeditions of the American School of Oriental Research, Jerusalem, excavated Tell el-Kheleifeh on the north shore of the Gulf of Aqabah. The site has been identified with Ezion-geber, which later on became known as Elath. The work of the first two seasons was made largely possible by grants from the American Philosophical Society, and that of the last season by a grant from the Smithsonian Institution.

The history of the site was found to have extended from the tenth to the beginning of the fourth century B.C. The excavations revealed that it was not only a seaport, from which Solomon's Tarshish ships sailed to Arabia, but that it was an important industrial center, and a strong fortress guarding the crossroads leading to Sinai and Egypt, to Arabia, and to Palestine. The most important single structure was an elaborate smelter-refinery, which, with its flue-holes and transverse air-channels in the walls, incorporated the modern principle of the blast furnace. The building was so oriented that prevailing winds blowing through the flue holes kept the flames in the furnaces going without the necessity of using a bellows system. The importance and strength of this small site may be judged by the fact that it was surrounded with a

double-wall system of fortifications, with a dry moat between the two walls, and a glaçis against each of the walls.

Five periods of occupation were discovered. In the level of Period III belonging to the eighth century B.C., was found a seal signet ring belonging to Jotham, king of Judah. His name was clearly incised in retrograde characters on the seal. In the same level was found the earliest Minaean inscription ever discovered in a controlled excavation. In level IV, belonging to the seventh century B.C., were found some stamped jar-handles, on which was impressed the legend "belonging to Qausanal, the servant of the king." Qausanal is an Edomite name, and Qaus or Qos is the name of an Edomite deity. Aramaic ostraca and contemporary black glazed Attic sherds were found in the last level, which may be dated to the fifth-fourth centuries B.C. The evidence of both revealed the existence of considerable commercial traffic between the Aegaean region and Arabia, with Elath—as the site was known in the latter part of its history—serving as a transshipment center.

Much of the material found at Ezion-geber:Elath is unique. In general, the impression gained from the excavations there is that despite the long control exercised over it by the Judaeans, its population, pottery, and general cultural patterns fit in more with the picture of Sinai and Arabia than of Palestine.

GLUECK, NELSON, 1939. Gateway to Arabia, Ezion-geber. Asia for September: 528–532.

—— 1940. Ezion-geber, "Singapore of Solomon." Asia for December: 663–670.

—— 1939. The second Campaign at Tell el-Kheleifeh (Ezion-geber:Elath). Bull. Amer. Schools of Oriental Res. No. 75: 8–22.

—— 1940. The Third Season of Excavation at Tell el-Kheleifeh. Bull. Amer. Schools of Oriental Res. No. 79: 2–18.

—— 1940. Ostraca from Elath. Bull. Amer. Schools of Oriental Res. No. 80: 3–10.

—— 1939. Ezion-geber. Illus. London News for August 5: 246–247.

—— 1940. Ezion-geber: the Pittsburgh of Palestine. Scientific American for January: 22–24.

MARY BUTLER, University Museum, University of Pennsylvania

Grant No. 181 (1937). Study of Maya archaeological material, chiefly pottery, from Chamá, Alta Verapaz, Guatemala.

As reported in the 1939 YEAR BOOK, Grant No. 181 was made for the purpose of establishing a sequence in the prehistory of the

Alta Verapaz that would permit not only dating of the early Maya remains in this northern department on the Atlantic drainage of Guatemala, but determination of the extent of its trade relations with the lowland area to the north and the highland area to the south, between which it forms an important link of communication. This in turn should throw light on the general archaeological problems of Maya chronology, the origin of Maya culture, and the means and manner of its diffusion.

Research and field work done in 1938–39 established, on the basis of a stratigraphical and typological study of associated artifacts, three main periods in the prehistory of the Alta Verapaz, the first characterized by heavy monochrome wares, the second by fine polychrome, incised, and carved decoration of cylinder jars, and the last by the appearance of Plumbate and Fine Orange wares and the degeneration of painted and cut techniques, due to the shift of emphasis from secondary decoration of a vessel to its form and texture. Two ceramic sub-areas were identified, one at Chamá on the Rio Chixoy, at the western edge of the Verapaz, the other lying about twenty-five miles southeast, in the Carchá-Coban region. Pottery from Chipal, west of Chamá in the department of Quiché, suggests that this site lies on the eastern edge of a pottery area quite distinct in character from that of the Verapaz.

The field season of February–April 1940, was spent at the site of Chamá, in the hope of finding dump material and stratigraphic evidence that would check the sequence worked out from a study of grave offerings from the same site. Chamá is a coffee plantation, at present abandoned, at the junction of the Tsalbá river with the Chixoy, one of the three headwaters of the Usumacinta, which flows northwest along the Atlantic face of the cordilleras to empty into the Gulf of Mexico. The mound complexes and terraced hills that succeed each other along the valley of the Tsalbá bear witness to the size of its pre-Columbian population.

Work was concentrated on three mound groups from which known pottery had come. Two of these, at Chamá proper, checked and expanded our knowledge of the middle or decorated cylinder jar period; the larger site also yielded a tomb that was intrusive in character and contained vessels of Plumbate, a late trade ware hitherto unknown at Chamá. A ball-court in this group had a central round stone marker, under which lay a dedificatory offering of a polychrome cylinder jar and layers of iron pyrites mirrors.

The plaza of the third site dug, about a mile up-stream at Chichun-Chamá, produced an early stone-grave cemetery, and a tomb, two meters below the surface, that checked the definition of the earliest period in this area and emphasized the contacts of the later phase of this period with the great stone cities of the Peten to the north. Both cemetery and tomb were overlain in part by the dominating mound of the plaza group, in which late, flexed, Plumbate burials were found at the same level as early extended ones. This site also yielded Plumbate refuse material on every mound tested, thus increasing our evidence for a Plumbate period at Chamá.

ARCHAEOLOGICAL EVIDENCE FROM CHAMÁ

	Research, 1938	Field Work, 1940, Chamá	Field Work, 1940, Chichun
Period I Black Ware	Chamá 1 Chamá 2		Chamá 2
Period II Decorated Cylinder Jar	Chamá 3 Chamá 4	Chamá 3 (?) Chamá 4	Chamá 4
Period III Plumbate: evidence at Chipal, Kixpek, etc.		Chamá 5	Chamá 5

A week of work in the Suchitepequez region on the Pacific slope added further evidence supporting 1939 conclusions that textile-marked pottery excavated there was late pre-Columbian.

The remainder of Grant No. 181, with a supplementary one, is being used to prepare for publication a report on the progress to date of the archaeological survey of the Alta Verapaz.

Butler, M., 1939. Apuntes arqueológicos sobre San Pedro Carchá. Fiestas Junianas, San Pedro Carchá, del 24 al 30 de junio de 1939.

—— 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 182–184.

—— 1940. A Pottery Sequence from the Alta Verapaz, Guatemala. The Maya and Their Neighbors, N. Y., 1940, pp. 250–267.

JOSEPH S. BUTTS, Oregon State College

Grant No. 445 (1940). Amino acid metabolism in relation to conversion to carbohydrate.

Previously we had found that when a racemic mixture of phenylalanine was fed to rats, definite liver glycogen formation occurred. Also an experimental alcaptonuria was established. These changes did not occur after an equivalent amount of dl-tyrosine.

In our present work, the metabolism of 1(—)-tyrosine was compared with the racemic phenylalanine and tyrosine. Using liver glycogen formation as a measure of carbohydrate synthesis it was found that 1(—)-tyrosine followed the same pathway as dl-phenylalanine and quantitatively was far different from dl-tyrosine. Confirmatory evidence was furnished when the effect of the amino acid on an experimentally induced ketonuria was studied. When the 1(—)-tyrosine was fed, a decrease in the ketonuria always occurred. This was interpreted as indicating sugar, or some carbohydrate intermediate, was being synthesized.

Using the same techniques as described above the metabolism of dl-valine was investigated. Small but significant glycogen deposition followed the feeding of the amino acid. Quantitatively this was found to be similar to glycine, in this respect.

BUTTS, JOSEPH S. (with SINNHUBER, R. O., and DUNN, M. S.). The Metabolism of 1(—)-Tyrosine. (Submitted for publication in the Proceedings of The Society for Experimental Biology and Medicine as a preliminary report.)

—— (with SINNHUBER, R. O.). The Metabolism of dl-Valine and dl-Isovaline. (Submitted for publication in the Journal of Biological Chemistry.)

DWIGHT C. CARPENTER, New York State Experiment Station

Grants No. 222 (1938) and 393 (1940). Effect of ultraviolet light on proteins and related substances.

We have shown that photolysis of the CONH (peptide) linkage takes place in stearyl amine, stearyl benzyl-amine and stearyl β-phenyl-ethyl amine upon irradiation of these substances as monolayers with ultraviolet light of 2537 Angstroms wavelength. Stearic acid and the respective amines are the products of this reaction.

The interposition of successive CH_2 groups between the light absorbing group (benzene ring) and the long chain acid radical and the successful breaking of these compounds by light energy shows that absorbed light energy may be expected to travel along a molecule until the weakest linkage is reached and the energy then expended in the breaking reaction.

To gain further knowledge about the effect of certain atoms and that of certain groups of atoms on the transfer of energy, the splitting of chain compounds such as glycyl anilide, anilino-acetic acid and anilino-acetic anilide, in which only the nitrogen atom intervenes between the light absorbing group and the place of splitting has been studied; also chain compounds in which the light absorbing group is situated on a side chain and the light energy must traverse several interposed atoms before arriving at the point of cleavage. Examples of the latter substances are the peptides, glycyl-tyrosin, tyrosyl-glycine and alanyl-tyrosyl-glycine.

Inasmuch as one of the hypotheses of protein structures (cyclol hypothesis) involves the possible cleavage of ketopiperazine rings, the following ketopiperazines having either the phenyl or phenolic group attached have been investigated; N-glycyl-N-phenyl glycine anhydride, N, N'-diphenyl-2,5 piperazinedione, N, N'-diphenyl-3,5 piperazinedione, glycyl-tyrosine anhydride and tyrosyl-tyrosine anhydride.

CARPENTER, D. C., 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 148.

—— 1939. Splitting Proteins by Means of Ultraviolet Light. Science 89: 251.

—— 1940. Splitting the CONH Linkage by Means of Ultraviolet Light. Jour. Amer. Chem. Soc. 62: 289.

JAMES EDWARD CARVER, College of the City of New York

Grant No. 288 (1938). Preparation of an edition of the North English Homily Cycle, a late 13th or early 14th century cycle of sermons and exempla for the church year, in twenty thousand lines of short English couplets.

Of the sixteen MSS pertinent to the edition of the Cycle, the writer has been able to examine at leisure and in detail all except one. The MS belonging to the Marquis of Bute must be considered as lost, since his Lordship does not know which of his houses it is in, and will not permit a search for it.

Before applying to the American Philosophical Society for a grant, the writer had examined in photographic reproduction the MSS of the Huntington Library and of the Royal College of Physicians of Edinburgh, and the Bodleian Ashmole MS 42. In England complete collations were made of the two important MSS of the Cambridge University Library, the one belonging to the Library of Lambeth Palace, the four belonging to the Bodleian Library at Oxford, the three of the British Museum, and two of the three in private hands.

Although the war cut short the writer's stay in England, he was able to finish the projected work because of the entire cooperation of Librarians and private persons. Dr. Jenkins, Librarian at Lambeth Palace, allowed the Lambeth MS to be examined at Oxford; and Lord Clifden sent his MS to the National Library of Wales at Aberystwyth, where Lord Harlech's MS is kept, and to which the British Museum MSS had been sent for the duration of the war. By having the MSS so centralized in three places, the writer was able to get on rather more rapidly than he had anticipated doing.

Upon his return to the United States in March 1940, the author went to Minneapolis where he collated the MS of the University of Minnesota. The time since then has been spent in preparing text of which a considerable part has now been sent to the Committee of the Early English Text Society, who propose to publish the edition.

The text of the Cycle is upwards of twenty thousand lines. For that reason, and because there are so many MSS, preparation for the press is a rather long task. However, unless events resulting from the war intervene to put a stop to the work, the writer anticipates that the edition will be published in the spring of 1942.

EDWARD F. CASTETTER, University of New Mexico

Grant No. 446 (1940). Investigation of primitive Indian agriculture in the American Southwest.

During the fall of 1940 studies of the primitive agriculture of the Papago, Pima, Yuma and Cocopa were completed. The study of Papago-Pima agriculture is nearly ready for publication.

Among these tribes the main topics investigated were:

1. Primitive agricultural implements.
2. Planting—time, method, technique, ritual etc., for each crop.
3. Cultivation—times, methods, irrigation, rotation of crops, fertilizing soil and ritual. Investigated for each crop.
4. Harvest—time, method and ritual for each crop.
5. Storage of crop—methods, place and ritual for each crop.
6. Seed selection and knowledge of inheritance. Methods of selection for each crop.
7. Crop utilization.
8. Kinds of crops grown anciently. Specimens were secured and grown in Albuquerque. These ancient crops were:
    - *a.* Maize—flour corn in white, red, yellow and purple colors. Red pericarp, purple aleurone and yellow endosperm.
    - *b.* Teparies (Phaseolus acutifolius). White and red varieties were most common. Occasionally spotted and black sorts were grown.
    - *c.* Pumpkins. The Yuma and Cocopa seem to have grown only Cucurbita moschata. The Papago grew this and C. pepo.
    - *d.* Tobacco. The Papago have grown Nicotiana tabacum, and the Pima, N. rustica, for a long time, although it was found impossible to determine whether its cultivation was aboriginal among them. Both tribes also smoked the wild species, N. trigonophylla and N. attenuata. There was no ancient cultivation of tobacco among either Yuma or Cocopa, these tribes having secured their tobacco from the tribes in southeastern California.
    - *e.* Cotton. There is little tangible evidence that Yuma or Cocopa grew cotton anciently. This practice seems to be a more recent development. Pima, and to a much less extent Papago, grew cotton aboriginally.
    - *f.* Gourds. All four tribes have been growing gourds for a long time, although the practice does not antedate European contacts by any long period of time.
    - *g.* The Yuma and Cocopa semi-cultivated several grasses by sowing them in the mud after the Colorado River had receded following its annual flood. Most important of these was Setaria italica.

CASTETTER, E. F., 1939–40. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 150–151; for 1939: 185–188.

LOUIS W. CHAPPELL, West Virginia University

Grants No. 317 (1939) and No. 426 (1940). Folk-culture in West Virginia: a collection of folk-songs and other types of folk-lore.

Folk-songs have first place in my project, to collect and preserve as much as possible of our folk-lore. At the present time I have 2500 folk-song recordings, 1500 of them on metal disks. More than 500 of them are American survivals of English and Scottish popular ballads, the type Professor Child of Harvard included in his famous five volumes. Most of the others, with or without New World adaptations, are also British in point of origin or of earlier history; and more than a few of them deserve to rank with the Child genre. Others are indigenous, or may be so designated. American folk-songs and British folk-songs, however, are the same oral tradition, long established among English-speaking peoples. However much my recordings may vary as art pieces,—and the range on that score is certainly great,—they are all valuable social documents. They are, moreover, the folk-songs of West Virginia, and they show that folk-songs have been made and sung in the state from its beginning, and are still being made and sung.

Other types in my folk-lore collection are equally important in terms of our oral heritage, though for the most part of somewhat less dignity than the folk-song. They are tales, legends, riddles, proverbs, superstitions, home remedies, regional dialect, and so on. Folk-tales and legends may, of course, achieve a high point of dignity, and actually do, not infrequently, in the state. The riddles are our folk-literature of cleverness, and the proverbs, of wisdom. Superstitions, home remedies, and dialect expressions come to even closer grips with reality in the life of the folk.

Five or six months will be required to complete the field work of my project. I shall be working from June 1 to September 15, 1941.

CHAPPELL, LOUIS W., 1939. "Folk-Songs of Roanoke and the Albemarle." The Ballad Press, Morgantown, W. Va.

VERNON I. CHEADLE, Rhode Island State College

Grant No. 442 (1940). Investigations of the vascular system in the Monocotyledoneae.

All parts of the plant of 146 species of 81 genera in 29 families were collected and killed during the summer of 1940. In addition,

materials gained from collections in other institutions during the same period totaled 25 species of 21 genera in 4 other families. Permanent slides were prepared of macerated tissues from various parts of the plant of 109 species in 79 genera distributed throughout 20 families; this series constitutes 1350 slides. Furthermore, about 300 permanent slides of sectioned materials were prepared.

In the families (as defined by Hutchinson) investigated to date, the most highly evolved vessels (as measured in terms of the perforation plates) are found throughout the plant only in the Gramineae, Cyperaceae, Juncaceae, Commelinaceae and Xyridaceae. Incomplete data collected from eleven tribes of the Gramineae indicate considerable uniformity (and a high evolutionary level) in the vessel type. The Cyperaceae are characterized by the presence of some intermediate vessels, in addition to the most highly evolved types, and the Juncaceae have a still larger proportion of the less highly specialized vessels. In the interesting aquatic families, primitive vessels were found in the roots of the Typhaceae, Sparganiaceae, Potamogetonaceae, Eriocaulaceae and Pontederiaceae, and highly specialized vessels in the Alismataceae. Excepting the Typhaceae, vessels were found nowhere else in the plant. In other aquatic families investigated, vessels are apparently absent throughout the plant.

Aside from a few aquatic families, the roots of all families have vessels of some sort. This is not true of the remaining parts of the plant. Our data indicate that the root leads in vessel evolution, and is followed in turn by the stem and leaves. Inflorescence axes are similar to the leaves in this respect.

On the other hand, the evolutionary series in sieve tubes (as measured by the position of the end wall), proceeds in the opposite direction, with the roots having the most primitive sieve tubes.

Our data in a broad sampling in the Monocotyledoneae are slowly accumulating to the point where the relation of habit and habitat to the vascular elements, the method of measuring evolutionary trends, the relation of vessel evolution to the form of the bundle, etc., may soon be confidently described.

CHEADLE, V. I., 1940 (with WHITFORD, N. B.). Notes on the Occurrence and General Structure of Sieve Tubes in the Monocotyledoneae. (Abstract.) Amer. Jour. Bot. 27 (Suppl.), No. 10.

T. T. CHEN, Yale University
(Now at University of California at Los Angeles)

Grants No. 47 (1935) and No. 102 (1936). *Cytological studies on Paramecium bursaria.*

(*a*) Polyploidy in Paramecium bursaria

The micronuclei in different races of Paramecium bursaria may differ a great deal in size and in the quantity of chromatin they contain. Among the six races carefully studied, race *Fd* shows an unusually small micronucleus containing a very small quantity of chromatin in contrast with the relatively large size of the micronucleus present in the other races. Such differences in size and in the quantity of chromatin are constant and characteristic and are correlated with the difference in chromosome number. Race *Fd*, which has a relatively small micronucleus, contains a relatively small number of chromosomes (apparently about 80), while each of the other races (polyploid) having larger micronuclei, has several times as many. During conjugation, it is noted that the pronuclei in the polyploid races are also larger and contain a much greater quantity of chromatin than those in race *Fd*. The macronuclei do not show such great diversity in size.

The most plausible explanation of the origin of polyploidy in Paramecium lies in the fusion of more than two pronuclei. In such conjugation the number of chromosomes is increased. The polyploid races in P. bursaria with several hundred chromosomes probably show the cumulative effects of several conjugations of this unusual type which have occurred at various times in the past. The origin of this increased number of pronuclei in a conjugant has three possible explanations: (1) the failure of one of the two products of the first or second pregamic division to degenerate; (2) the conjugation between a normal animal with a single micronucleus and an animal with two micronuclei; or (3) the failure of the migratory pronucleus in one of the conjugants to migrate to the other conjugant, so that there are three pronuclei in one conjugant and one pronucleus in the other.

Polyploidy is apparently a common phenomenon in P. bursaria. Polyploidy evidently also occurs in P. caudatum.

(*b*) Conjugation of Three Animals in Paramecium bursaria

In Paramecium bursaria, in addition to the usual pairs, three animals may conjugate. Nuclear changes occur in all of the three conjugants. Conjugation of three animals is of more than cytological interest because it throws light upon some physiological aspects of conjugation in Paramecium.

There are several ways in which the three animals conjugate. In the usual type of association, two of the three conjugants form an ordinary conjugating pair while the third conjugant attaches itself to the posterior part of one of these conjugants. The contact between the third conjugant and the conjugant to which it is attached is at only a small, sometimes a very small region of the body. *Such contact at a small or a very small region of the body is sufficient to initiate in the third conjugant all the usual nuclear changes accompanying conjugation in Paramecium.*

Nuclear changes take place in all of the three conjugants at about the same rate as those in ordinary conjugating pairs. In many cases the nuclear changes are synchronous in all three animals, but often the nuclear events in the third conjugant lag behind. In each conjugant two pronuclei are formed as a result of three pregamic divisions. Exchange of pronuclei takes place only between the two anterior conjugants, never between the third conjugant and the conjugant to which it is attached. In the third conjugant there is also a differentiation of the two pronuclei into migratory and stationary pronuclei even though there is no exchange. The two pronuclei may exhibit differences in shape or in behavior or in both. The migratory pronucleus in the third conjugant also moves to the vicinity of the mouth region just as if a conjugant were attached to that part of the body. The migratory pronouclens of the third conjugant later fuses with the stationary pronucleus in the same conjugant to form a syncaryon. Autogamy thus occurs in the third conjugant.

Conjugation of three animals offers an unusual opportunity for studying possible influence of contact at the mouth region (between two conjugants) on the behavior of pronuclei. In the ordinary conjugating pair, the two animals come in contact at the mouth region and the migratory pronucleus moves to the vicinity of this region. We may inquire whether the direction of the movement of the migratory pronucleus (to the vicinity of the mouth region)

might be due to the influence of the contact at the mouth region between the two conjugants. In conjugation of three animals, the third conjugant does not come in contact at the mouth region with any other conjugant, hence any possible influence of the contact at the mouth region on the direction of the movement of the migratory pronucleus is eliminated. Yet the migratory pronucleus of the third conjugant always moves to the vicinity of the mouth region as if a conjugant were attached to that region of the body. *This indicates that the path of the migratory pronucleus is predetermined. Contact at the mouth region between conjugants (in ordinary conjugation) does not induce the migratory pronucleus to move in that direction.*

CHEN, T. T., 1940. Polyploidy in Paramecium bursaria. Proc. Nat. Acad. Sci. 26: 239–240.

—— 1940. Polyploidy and Its Origin in Paramecium. Jour. Hered. 31: 175–184.

—— 1940. Conjugation of Three Animals in Paramecium bursaria. Proc. Nat. Acad. Sci. 26: 231–238.

—— Observations on Conjugation of Three Animals in Paramecium bursaria. Jour. Hered. (In press.)

ROBERT T. CLAUSEN, Cornell University

Grant No. 377 (1939). Taxonomic and distributional study of the genus Sedum; taxonomic and distributional study of the genus Gentiana.

Taxonomy continues to offer numerous challenging problems for investigation. Studies of Sedum, begun in 1935, and the Gentianaceae, begun in 1938, support this contention. Although Sedum has been monographed in recent times by Rose, Praeger, Berger and Fröderström, the classifications of these workers appear decidedly unsatisfactory in the light of researches carried on in the field in 1940. Likewise, much revision is necessary in Gentiana and related genera.

The field-work in 1940 was in the western United States. It lasted from the first of June to the end of September. A trip of 18,295 miles yielded 3,919 sheets of herbarium specimens representing 886 different numbered collections, 195 collections in preservative for cytological and morphological studies, 105 collections of seeds and fruits for germination, 51 collections of living plants for cultivation, and 521 photographs of plants and habitats. Detailed color-descriptions accompany the herbarium specimens of all Cras-

sulaceae and Gentianaceae. These were prepared from the fresh plants with the aid of color-charts. Although the primary object of the field-work was to observe and study the range of variation of the plants in their natural habitats, there was some time to visit gardens and conservatories and to examine dried specimens in herbaria. Also, it was possible to study important types at the California Academy of Arts and Sciences, Los Angeles Museum, Pomona College, Stanford University, University of California, the University of Oregon, and Williamette University.

Sedum and related genera received chief attention in 1940, since the studies of this group have progressed further than those of Gentiana. In all, about 110 names were investigated in the season just completed. It is now possible to write that there has been personal experience in the field with almost all the species of Sedum described from the western United States. Further, topotypic matrial was obtained for most of the names studied. Of those species which were not seen in the field, it has been possible either to obtain authentic specimens from other botanists or to study the type collections. Result of all of this is a great accumulation of specimens, notes, and photographs which are now in process of organization for publication. Generic groups must be rearranged and species redefined in accordance with the new data. In this report, it is best not to discuss the various altered concepts and nomenclatorial innovations which are necessary. It may be remarked, however, by way of illustration of how confused has been the literature on Sedum, that one common species of Arizona and New Mexico is currently passing in manuals and in monographs as five different species (one of these even put in a different section of the genus); that another valid species has been confused with the foregoing and reported from the higher altitudes where that occurs, whereas it is restricted to low altitudes of the Rio Grande Basin; that a natural group of species has been placed by one monographer in two different sections, and by three others has been hopelessly confused by the addition of unrelated species; that a species from Texas, thrown in synonomy by other workers, is undoubtedly valid; and that a species hitherto known only from the mountains of Mexico occurs on talus slopes in the Chisos Mountains of Texas. These are typical of the findings which the grant from the Penrose Fund has made possible.

While searching for Sedum, there was opportunity to obtain a good series of Gentianaceae, also to examine types and other preserved material of species in this family. In all, about 50 names were investigated. A preliminary publication is in progress on this group, indicating the results of the field-work. Meanwhile, studies of the gentians of the Atlantic Slope have continued. These investigations do not support the views advanced in recent publications by Fernald and indicate that certain changes made by him are not valid. These discrepancies will be discussed fully in a future publication.

The purpose of the work described above, in both Sedum and Gentiana, is to lead towards authoritative revisions of the North American species of the two genera, also of general treatments of the species in cultivation in North America. For the consideration of the cultivated plants, species from all parts of the world will be investigated. To do this thoroughly, it will be necessary to continue the studies for many years and to do much more field-work, particularly in remote regions.

Besides the grant from the Penrose Fund, there was also a generous grant from the Trustee-Faculty Committee on Research of Cornell University. Before either of these grants was received, one article was published on the Crassulaceae in 1940.

Clausen, Robert T., 1940. Studies in the Crassulaceae: Villadia, Altamiranoa and Thompsonella. Bull. Torrey Club, 67: 195–198.

Dean A. Collins, Temple University School of Medicine

Grant No. 417 (1940). Experimental renal hypertension: Studies on the elevation of blood pressure resulting from the restoration of renal circulation after periods of complete interruption.

This investigation was made in order to compare responses obtained from restorations of circulation through the completely ischemic spleen and kidney. It is known that reestablishment of renal circulation after complete ischemia results in a prolonged rise of blood pressure due to the liberation of pressor material by the ischemic kidney. This renal phenomenon is of interest because of a possible relationship to the hypertension resulting from chronic, partial renal ischemia. It is of primary importance to determine whether organs other than the kidney give similar results; hence this investigation of the spleen was made. With the

collaboration of Dr. A. S. Hamilton the following conclusions were reached:

1. When clamps which have been applied to the splenic pedicle for about two hours (to produce complete ischemia of the organ) are opened, a prolonged pressor response occurs.

2. Volume changes of the spleen are not responsible for the phenomenon, although they may modify it. (Earlier experiments had given support to the erroneous idea that the elevation of blood pressure was due to splenic contraction.)

3. The pressor response does not occur when the greater splanchnic nerves have been sectioned; hence it depends, unlike the renal response, upon nervous mechanisms.

4. Removal of the spleen does not prevent the response. Thus it depends solely upon a nervous reaction from the pedicle of the spleen, and not, as does the renal phenomenon, upon the liberation of pressor material from the ischemic organ.

5. In view of the last two findings it may be concluded that the phenomenon involves different mechanisms than does the pressor response following restoration of circulation through the completely ischemic kidney. With reference to other organs, namely muscle and liver (previous investigations) and now spleen, the kidney is unique in producing pressor material during complete ischemia.

A. H. Compton, University of Chicago

Grant No. 427 (1940). Studies of cosmic rays at high altitudes.

Dr. W. P. Jesse has been making periodic balloon flights at the rate of about one per month with a recording ionization chamber apparatus for the purpose of studying the time variation of the total cosmic ray intensity. In these flights the apparatus is carried to altitudes of about 15 miles at which altitude the cosmic ray intensity has already reached its maximum value and has begun to decrease. The results of his flights show variations with time of cosmic ray intensity at high altitudes of as much as 20 per cent, the greater part of which follows the world wide changes caused by changes in the earth's magnetic field. In addition to this type of variation, there seems to be a possible seasonal effect for which the intensity is a maximum in the winter and a minimum in the summer.

Dr. M. Schein, Dr. W. P. Jesse and Dr. E. O. Wollan have been carrying out experiments on the intensity of the mesotron component of cosmic rays as a function of altitude and also of latitude. These experiments have been done with an arrangement of coincidence counters between which has been placed from 10 cm. to 18 cm. of lead for the purpose of excluding the soft component and permitting only the mesotron component of the cosmic rays to be recorded. The complicated nature of the equipment and the necessity of using lead absorbers have made these pieces of equipment weigh from 25 lb. to 40 lb. and from 12 to 21 balloons have been required to carry the apparatus to heights of from 12 to 15 miles. Flights have been made from Chicago and from Waco, Texas. The flights from both places have given information about the increase in the mesotron intensity with altitude, the secondary nature of mesotrons, the increase in the rate of production of mesotrons with altitude and the nature of the radiation responsible for generating the mesotrons as secondaries in the earth's atmosphere. A comparison of the data obtained in Texas and in Chicago shows the mesotron intensity at high altitudes to be latitude sensitive and from the magnitude of this latitude effect the energy necessary for the creation of mesotrons in the atmosphere has been qualitatively determined.

Dr. G. Herzog and Mr. W. H. Bostick have made airplane flights up to an altitude of about 29,000 ft. with a counter controlled cloud chamber operating in a magnetic field. With this apparatus they have taken several hundred photographs of individual cosmic ray tracks at high altitudes out of which about 50 tracks can be identified as mesotrons near the end of their range. In the few hours occupied in these flights they have obtained more photographs of slow mesotrons than have been observed in hundreds of hours of operation of similar apparatus near sea level.

In the airplane flights mentioned above another coincidence counter experiment was performed by Dr. M. Schein, Dr. E. O. Wollan and Dr. J. Groetzinger. This experiment was designed to measure the energy spectrum of mesotrons at high altitudes and to give additional information about the nature of the radiation responsible for the creation of mesotrons. In regard to this latter point it was found that neutrons do not contribute materially to the production of mesotrons at these altitudes.

JESSE, W. P., 1940. A Study of Time Variations of Cosmic Rays at High Altitudes. Phys. Rev. 58: 281–287.

HERZOG, G., 1940 (with BOSTICK, W. H.). Pair Production of Mesotrons at 29,000 Feet. Phys. Rev. 58: 278.

SCHEIN, M., 1940 (with WOLLAN, E. O., and GROETZINGER, G.). A Study of the Production and Absorption of Mesotrons in the Substratosphere. Phys. Rev. 58: 1027–1031.

B. R. COONFIELD, Brooklyn College

Grant No. 349 (1939). Investigation on the problems of regeneration in the ctenophores and color change in embryo fishes.

1. The development and reaction of melanophores of embryos and larvae of the blind goby, Typhlogobius californiensis Steindachner. (Manuscript in preparation.)

Embryos and larvae of the blind goby, Typhlogobius californiensis Steindachner were observed from the beginning of development through ten days of larval growth for their melanophore development and responses under experimental conditions. Their melanophores were formed from very finely divided bodies of pigment which appeared in the skin on the fourth day of embryonic development. These melanophores responded to light and to darkness slightly on the seventh day of development. A more complete response was exhibited by these structures on the eighth day. These melanophores contracted when in light and over a white background, expanded in light and over a black background, and contracted when in total darkness. This response was maintained by the larvae though of less completeness. The older larvae gave less vigorous melanophore response to these stimulations than did the younger larvae, with the exception of those kept in darkness. Any response to backgrounds in light by ten day old larvae was difficult to detect. It is believed that the melanophores of the embryos and larvae of this fish respond directly to stimulations in light and to darkness.

2. Color change in embryos of Raja binoculata Gerard. (Manuscript in preparation.)

The embryos of Raja binoculata Gerard were collected in egg cases at twenty fathoms near Crane Island of the San Juan Islands, Washington, during the summer of 1940. These embryos were removed from the egg cases and were kept in the laboratory under

experimental conditions at the Oceanographic Laboratory of the University of Washington.

These embryos begin to form pigment relatively soon after the pectoral fins show definite enlargement. The melanophores at this stage in development, however, did not show definite responses to environmental changes. For this reason the older embryos were used in the main in these experiments. It is true also that both epidermal and dermal melanophores are present in the skin of these embryos, but since the writer believes that the color pattern is due primarily to the dermal pigment the reactions of these bodies were observed principally. The results of experiments with these embryos are given briefly in the summary which follows.

The older embryos were dark in tint when they were removed from the egg cases. This dark tint became pale on the fourth day when the embryos were kept in white pans under continued illumination. When these embryos were kept in black bowls under continued illumination they became dark in tint on the seventh day. No response in color change was given to cuts made either through the dorsal and ventral skin or to cuts made completely through the pectoral fins. In response to injections of 0.1 cc adrenalin chloride (Parke Davis, 1 : 1000) the embryos became pale within 12 hours. These specimens returned to their former tint in color three days later. Injections of fresh pituitary extract made from the pituitary of the dogfish brought about a definite darkening of these skate embryos within one day. Enucleated specimens became pale immediately following the operations and this pale tint was retained for two days. Four days after this tint had been reached the embryos became dark and remained in this condition indefinitely. Specimens ranging from the time when pigment was beginning to form to include the later stages when the pigment pattern was definitely formed were allowed to develop, some in white pans under continued illumination and others of the same litters in total darkness. At the end of two weeks all were observed and compared with regard to the conditions of the pigment. The older ones which had been kept in darkness showed less pigment than their mates which were kept in the white pans under continued illumination. There was no visible difference in the condition of pigment of the younger specimens. The epidermal melanophores were in the main involved in the latter ob-

servations. In certain respects the results of experiments on the embryos of Raja binoculata are similar to those obtained by Parker[1] on the newly-born of Mustelus canis.

3. Regeneration in Pleurobrachia bachei. (Manuscript in preparation.)

Cuttings were made at several levels and through various planes of the body of Pleurobrachia bachei to compare its ability to regenerate with that of Mnemiopsis leidyi. The following results were obtained. When the section was made along the oral-aboral axis only the halves which retained the original apical organ regenerated. All other parts died within two weeks without regenerating either the apical organ or plate rows. When the section was made across the body, dividing it into an oral piece and an aboral piece only the aboral piece which retained the apical organ would re-regenerate. These pieces formed new plates at the cut end and this end healed over within a few days. The other pieces failed to heal over the cut surface and died within two weeks without showing any signs of regeneration. These results show a considerable difference in ability to regenerate as shown by Mnemiopsis according to Coonfield.[2] The stages shown during the regeneration of the plate rows by those pieces which did regenerate were exactly the same as shown by Mnemiopsis as reported by Coonfield.[3]

ARTHUR C. COPE, Bryn Mawr College

Grant No. 319 (1939). A study of three-carbon tautomerism between 1-alkenyl and alkylidene malonic esters.

With the aid of a grant from the Penrose Fund, research has been conducted on the preparation of 1-alkenyl malonic esters from the sodium enolates prepared from alkylidene malonic esters. Decomposition of ether suspensions of the sodium enolates prepared from ethyl isopropylidene, 1-methyl propylidene and cyclopentylidene malonate with acids was found to produce ethyl isopropenyl, 1-methyl propenyl and 1-cyclopentenyl malonates. The β, γ-unsaturated esters so prepared contained from 1.6 to 3.0 per cent of the original α, β-unsaturated esters. The exact amount of the α, β-unsaturated isomers present was determined by means of polaro-

1 Parker, G. H., Biol. Bull., 70: 1–7 (1936).
2 Coonfield, B. R. Biol. Bull., 71: 421–428 (1936).
3 Coonfield, B. R. Proc. Nat. Acad. Sci., 22: 152–158 (1936).

graphic analysis, a method which has not previously been applied to the analysis of such systems, which should be quite generally applicable to the analysis of similar mixtures in cases where the pure α, β-unsaturated form can be isolated. The α, β- and β, γ-unsaturated isomers have been found to reach equilibrium on heating in the presence of hydrogenation catalysts.

COPE, ARTHUR C., 1940 (with HARDY, ELIZABETH M.). The Regeneration of Substituted Vinyl Malonic Esters from their Sodium Enolates. (Paper VI: The Introduction of Vinyl Groups.) Jour. Amer. Chem. Soc. 62: 3319–3323.

L. S. CRESSMAN, University of Oregon

Grant No. 302 (1939). Archaeological exploration and excavation in southeastern Oregon.

Work was conducted during the summer of 1940 for a period of approximately six weeks in the Lower Klamath Lake basin extending from southern Oregon into northeastern California. The problems in this work were: (1) to verify the association of fossil mammalian fauna and artifacts, to discover whether the association was primary or derivative; (2) to establish the cultural horizons represented in the lake bed; and (3) to establish a chronology for the different horizons.

Description of Lower Klamath Lake. Lower Klamath Lake was formed by a backwater from the outlet of Upper Klamath Lake. It was thus an appendage of Upper Klamath Lake rather than a true Basin lake. The lake was dried in 1917 by the Bureau of Reclamation and has been dry since that time. Upper Klamath Lake drains out through the Klamath Gorge approximately two miles west of the intake for Lower Klamath Lake. An additional outlet was provided for Upper Klamath Lake by what is known as the Lost River Slough. This was a depression through which water flowed out of Upper Klamath Lake some distance above the intake for Lower Klamath Lake whenever any rise occurred in the level of Upper Klamath Lake and the subsequent run-off. Water drained out through the Lost River Slough and disappeared in the Tule Lake Sump, in the basin just to the east of Lower Klamath Lake. This relationship of Upper Klamath Lake and the drainage system just described is of importance in interpretation of the history of the lake and its human occupation.[1]

[1] Antevs, Ernst. Yr. Bk. Carnegie Inst. Wash. for 1939–40: 307–309.

All sites related to Lower Klamath Lake are either lake bed or shoreline sites. Included in the latter should be the islands, which were largely consolidated masses of tule and peat, and which were reached during the period of the modern lake by Indians from the shoreline using dugout canoes.

In modern times the lake was a mass of waving tule and cattail, with an open "channel" extending from the intake through the lowest part of the lake bed, running in the main north and south to the south end of the lake where it turned east for some distance. This open "channel" was not a true channel, but one that was maintained because the lake was evidently too deep there for peat to form, with certain slight currents kept in motion as a result of wind action, differential levels of the lake bed, and pressure through the intake. Since there was no outlet, the lake was entirely responsive to the rise and fall of water in the outlet of Upper Klamath Lake and the subsequent increase or decrease of pressure. It was along this so-called channel that the association of fossil fauna and artifacts occurred. The fossil fauna consist of horse, camel, elephant, carnivores, etc.

After the lake was dried in 1917 the peat beds were fired and burned for some years. High winds then blew out the ash. After the burning, Mr. Frank A. Payne of Klamath Falls began collecting from this area, and over a period of ten years made a careful and systematic collection of artifacts from the lake bed. An area would be collected over and then following another windstorm he would return to the area and collect newly exposed artifacts. Mr. Payne became convinced of the possible importance of this area as contributing to the knowledge of Early Man, and brought it to the attention of the Department of Anthropology of the University of Oregon. I wish to express my appreciation to him for his generous, unselfish, and thoroughly scientific attitude in connection with the development of this project.

Association of Fossil Fauna and Artifacts. Along the "channel" have been found varieties of fossil fauna and characteristic types of projectile points, grinding stones, knives, scrapers, pestles, and a type of fossilized bone point which varies in length from eight to eleven inches. This last is apparently a foreshaft. It is pointed at one end and beveled at the other, apparently for lashing. Trenching was carried out in the area of the "channel," but very meager evidence of association was found. One site did turn

up evidence which is convincing, especially when considered in connection with the other aspects of the situation. In a small uneroded eminence of lake deposit a scraper and a fragment of projectile point were found along with fragments of fossil ivory. The ivory was evidently part of the tusk of an elephant, some of whose remains were found in the immediate vicinity. The two artifacts here referred to were removed in troweling and were in undisturbed deposits. Microscopic examination shows that they have not been subject to sand-blasting. All the objects of any kind exposed for any length of time on the surface of the lake bed are pitted by the constant sand-blasting which they undergo.

It is the opinion of Mr. Payne, which my experience has confirmed, that the fossil bones and the artifacts in the "channel" area were all eroded from the same level and type of deposit, the one from which came the two artifacts referred to immediately above.

Cultural Horizons Represented. Three distinct cultural horizons are represented: the first horizon represented by the Narrows; the second by the materials from Laird's Bay at the extreme southern end of the lake at the outer margin of the peat beds; and the third by the historic culture of the shoreline and islands. The earliest horizon, at the Narrows, is represented by crude willow-leaf-shaped projectile points, frequently flat on one side with a marked dorsal ridge on the other. In addition to this there are large points straight across the base with side notches. A modification of the willow-leaf type having a very poorly developed tang also occurs. The second type occurs with greater frequency than the willow-leaf type in the Laird's Bay locality. The Laird's Bay locality does not seem to have the fossil fauna characteristic of the Narrows, although some fossilized specimens have been found on the surface. We cannot be sure whether these were in their original location or had been carried and dropped. The Laird's Bay locality lacks the fossilized bone foreshafts. This seems to be the really distinguishing difference between the Narrows and the Laird's localities; and it is on this ground and that of the different proportion of projectile point types that the separation into two distinct cultural horizons is made. A third piece of evidence showing that Laird's Bay deposits represent a different horizon from that of the Narrows is to be found in the fact that it represents a considerably later period of development.

Chronology. Chronological estimates are based upon climatological sequences as indicated by a study of abandoned beaches. Under ordinary conditions, if this lake were directly responsive to precipitation as affected by climatological changes, there should have been at least two abandoned beaches, a higher representing the last Pluvial and a lower representing the Little Pluvial (Antevs). However, only one abandoned beach, approximately seven feet above the modern lake level, was to be found. It is my opinion that the reason for this is that this level represents a maximum height which this lake could have reached under the conditions applying to it. These are: (1) the outlet to Upper Klamath Lake through the Klamath Gorge; (2) the fact that Lower Klamath Lake would act as a dam against further intake when it reached a certain height; and (3) a secondary outlet of Upper Klamath Lake, called Lost River Slough, which carried overflow when Upper Klamath Lake rose a slight amount above its customary elevation. This opinion is based upon the assumption that Lower Klamath Lake was caused by climate changes and not geological phenomena such as faulting.

The occupation at Laird's Bay would have taken place when the lake was reduced to the size of a slough along the "channel." This would have had to take place when the lake was beginning to re-fill at the time of the Little Pluvial; and consequently the second horizon is to be dated not less than 4000 years ago. If the culture represented in the Narrows constitutes an original association with the fossil fauna, as I believe it surely does, then 3000 or 4000 years at a minimum would have to be added to this to date the Narrows or earliest occupation. This would then indicate that the Narrows and Laird's Bay sites represent two distinct horizons in time.

The historic horizon is represented by the characteristic Klamath-Modoc type of material culture of historic times and is to be found along the recent shoreline of the lake and on the islands. This is below the old abandoned beach. The maximum date for the start of this phase would be the beginning of the Christian era.

It is difficult, if not impossible, on the assumption of localized tilting, to establish any chronology.

The hypothesis of climatic changes having caused the changes in lake levels here is much more convincing to me because it fits into the general pattern and gives significance to facts which otherwise lack it. For example: The mixture of mammalian fauna along the "channel" is suggestive of the thesis that here was the only

available water in a large area, and that these animals of different kinds crowded in to drink and feed in the swamp, while the carnivores came both for water and to feed on the other animals. Man also came in for the water and to hunt the game. This would indicate that the lake had been in existence and was drying up toward the end of the last Pluvial, some 10,000 years ago, when these Pleistocene and early Recent fauna were on the way to extinction.

If the tilting hypothesis is assumed and the association is original, as there is no doubt in my mind that it is, then we should have to assume that the tilting occurred before the extinction of these animals; and once formed, the lake became dependent upon climatological sequences; and we are back where we started from. These difficulties are all solved by the first explanation, and an intelligible pattern is provided.

These conclusions are tentative, based upon field observation and preliminary study, and are subject to changes on further analysis of the material. Arrangements have been made to have the detailed peat analysis made of the area, which should help throw some light on this rather complex problem. Dr. Paul S. Conger of the Carnegie Institution is studying the diatoms for evidence on climatic conditions.

Additional financial assistance was provided by Dr. John C. Merriam, under his President-Emeritus Research Program on Early Man in South Central Oregon; and by the General Research Council of the Oregon State System of Higher Education.

CRESSMAN, L. S., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 194–196.

—— Studies on Early Man in South Central Oregon. Yr. Bk. Carnegie Inst. Wash. for 1939–40: 300–306.

FRED E. D'AMOUR, University of Denver

Grants No. 371 (1939) and No. 371a (1939). The simultaneous determination of estrogen, gonadotropin and pregnanediol in normal female urine.

In this study the daily urine excretion, during 29 menstrual cycles, of five subjects, was assayed for estrogen and gonadotropin, four cycles being repeated with variations of dosage. The results are being published, and are briefly as follows:

1. As regards time of ovulation. Of the 29 cycles, 25 gave evidence of ovulation occurring between the 12th and 16th days pre-

ceding the onset of the next menstruation; the other 4 were considered anovulatory.

2. As regards hormone excretion levels. The amount of gonadotropin produced during peaks of activity was equivalent to from 4 to 16 International Units. Some evidence was obtained supporting the view of hypophyseal activity at other times than the mid-interval. The excretion of estrin took place in two waves, the daily output at the peak being approximately 800 I.U. Some degree of estrin excretion may take place at all times during the cycle except during the first week.

3. As regards time relationship of hormone excretion. Invariably the ovarian activity, as indicated by increasing estrin excretion, precedes hypophyseal activity, as indicated by the gonadotropin peak. On the basis of this finding, a theory of the mechanism controlling ovulation is tentatively suggested.

No satisfactory method for determining the pregnanediol excretion on the same urines has been worked out. Study of this phase of the problem continues. In addition, the type of estrogen being excreted (whether estrone, estradiol or estriol), is being investigated, as this may shed some light upon the question of its origin.

D'Amour, F. E., 1940. Further Studies on Hormone Excretion during the Menstrual Cycle. Am. Jour. Obst. and Gynec. 40, 6: 958–965.

Charles B. Davenport, Cold Spring Harbor, N. Y.

Grant No. 324 (1939). Postnatal development of the extremities in Homo.

The data collected as a result of the measurements through a series of years of individual children, in order to get at the principles governing their growth, have been collated and the results in part published. At the present time the data derived from the measurement of the extremities are being studied in systematic fashion. The course of development of the parts and the proportional changes in such development are being graphed and analyzed. The grant from the Penrose Fund helped in putting the paper "Post-Natal Development of the Head" into form for publication. This paper emphasized the conclusion that the cranium is a highly plastic organ and undergoes changes in form even after the closure of the sutures of the cranial bones. The changes in the proportions of the visceral parts of the head depend upon a number of processes such as the development of the teeth and their alveoli, the

development of the maxillary sinus, the thickening of the frontal bone and the sinus formation occurring in the glabellar region. The development of the head reveals the influence of determiners that were most functional in ancestors of man and that are now largely inactivated by new and later determiners or genes. Illustrations of this principle are found at every stage: e.g., in the replacement of a small postauricular segment by a large one; in the more rapid postnatal growth of head height than head width; in the late backward migration of the auricles giving more room for the frontal part of the cerebrum; in the uncertain and futile development of the frontal sinus.

The form of the adult living head shows itself, indeed, as the product of both environmental and genetical factors, and the genetical factors are both old and new or recent; and between them there is, as it were, a struggle during development, the new factors coming into function later and having the most influence on the details of the final human form as contrasted with the anthropoid form.

The study of the head also revealed a series of important changes in the sella turcica accompanying individual development. These result generally in enlargement, but sometimes even in decrease in the size of the sella, suggesting that the bones constituting the walls of the sella are able to reconstruct themselves to meet varying size of the pituitary body in a negative as well as a positive direction.

The study of the growth of the extremities reveals the fact that the different bones of the extremities do not grow at corresponding rates, but frequently in inverse ratios, suggesting that when the growth accelerating processes are being utilized by one bone they are being, as it were, withdrawn by the other principal long bone of the extremities.

DAVENPORT, C. B., 1939. Post-Natal Development of the Head. Proc. Amer. Philos. Soc. 80: 175–355.

—— 1940 (with RENFROE, O.). Adolescent Development of the Sella Turcica and the Frontal Sinus based on Consecutive Roentgenograms. Amer. Jour. Roent. Rad. Thera. 44: 665–679.

JOHN H. DAVIS, JR., Southwestern College

Grant No. 447 (1940). Insular changes among the Florida Keys due to mangrove and strand vegetation.

During the summer of 1940 studies of the extensions of the islands of the Florida Keys west of Key West including the Tortugas

Keys were made. Some previous studies of the islands had been made in 1937 and 1938 through the aid of the Carnegie Institution of Washington and part of this summer work was similarly aided. Descriptions of the islands and their vegetation by Millspaugh in 1907 and Bauman in 1918 furnished a means of comparison between present and past conditions. Changes in the sizes and shapes of the islands and in the different plant communities which form their vegetation were the main objectives of the study. In this, as in previous studies of the south Florida region, the ecology of the vegetation and its geologic rôle were especially stressed.

Fairly accurate plane table mapping and comparisons of old maps with present conditions furnished the bases for estimating changes. Many changes in the coast line and in some inland parts of the islands have occurred. Most of these changes are a progressive building up and outward of finer sediments in the flooded mangrove swamp parts of the islands, and the accumulation of calcareous sands and other detrital material on the strand parts of the islands. Changes in vegetation accompany these changes and in a number of ways promote them. Detailed maps of the changes and descriptions of the vegetation will be published later.

The thirty islands studied are in three main groups. Ten extend from Key West to Boca Grande Key. These are based on the Miami oolite limestone that is an extension of the rock of the lower Florida Keys. Strand vegetation holds most of the dune and beach sands in place, but since most of the islands are wholly or partially of very low relief, mangrove colonies and some mature mangrove swamps are most abundant and contribute most toward island formation. The most elevated and stable parts of some of these islands have developed a scrubby type of tree and scrub hammock vegetation.

The second group of about ten islands, the Marquesas Keys, is a roughly elliptical atoll enclosing a shallow lagoon. It is, however, not probable that this group was derived from coral reefs, as the islands are based on the same limestone as the first group. The islands are mostly built up detrital material with mangrove swamps on the sides facing the lagoon and strand vegetation on the calcareous sands facing outward. A number of changes in the sizes, number, and shapes of these islands have occurred. The vegetation on the largest island, Long Beach Key, is well advanced, having developed into a thick tropical forest hammock on the higher sand dune areas.

The third group, the Tortugas Keys, about 40 miles west of the Marquesas atoll, is also a group of islands being formed about central lagoons but the channels are deep and coral reefs are abundant. Of the eight islands two are very intermittently above high tide. Since a fort and lighthouse are here much is known of the history of the group. The largest island, Loggerhead Key, has been extending itself along its northeast-southwest axis. Garden Key, the site of Fort Jefferson, has changed very little. Bush Key has enlarged greatly due mainly to the coalescence of two of its former parts. On the coral debris shoal of Long Key over four thousand red mangrove seedlings have been planted which may aid in more rapidly building up this island. Bird Key has been below normal tide for some years but is now reappearing. Middle Key is now, since 1937, below normal tide. The vegetation of these islands is not as well advanced as that of the other two groups. Mangroves play little or no part in the building up of the calcareous sands. The native strand vegetation has been supplemented by many plantings, particularly on Loggerhead Key, and some of these plants have aided in the development of a more stable vegetation.

The study indicates not only insular changes and the rôle of vegetation in some of these changes but also serves as one of a series of descriptions that should be continued from time to time so that a long term record of changes may be recorded in these insular microcosms.

Davis, John H., Jr., 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 162–164.

—— 1938. Ann. Rpt. Tortugas Laboratory, Car. Inst. Wash. for 1937–38: 90–91.

—— 1940. The Ecology and Geologic Rôle of Mangroves in Florida. Car. Inst. Wash. Pub. No. 517: 303–412.

Artheme A. Dutilly, Catholic University of America

Grant No. 461 (1940). (*a*) To complete collections of North American Arctic flora. (*b*) Preservation by photography of the linguistic material, such as manuscript dictionaries, grammars, etc., accumulated in the last eighty years by missionaries along the Mackenzie River.

The Indian language manuscripts brought to Washington for examination numbered twenty-one. All have been copied on 35 mm. film, the negatives being deposited at the Catholic University of America so that positives may be made for scholars desiring to

study these languages. All the MSS were written by members of the Oblates of Mary Immaculate, and the names of the authors are recorded except for five of them which remain anonymous. Some of them belong to the archives of the Oblate Provincial House at Edmonton, Alberta, to which they have been returned by agreement, the others belong to individuals using them for their own training in different missions (Mackenzie River: Good Hope, Fort Smith, Fort Simpson; Yukon: White Horse, Teslin Lake; British Columbia: Prince-Rupert, Fort Nelson).

The content of the MSS is as follows: two Cree-French dictionaries; one French-Cree dictionary; three Cree grammars; one Comparative Study of various Algonquian languages; three French-Athabascan (Montagnais) dictionaries; one French-Athabascan (Slave) dictionary; two Athabascan (Slave) grammars; one Old Testament History in Slave; one similar text in Slave; one Sioux (Assiniboine)-French dictionary; one Koluschan (Thlingit) dictionary; one French-Blackfoot dictionary; one Cree-French-Blackfoot dictionary.

Most of the MSS are undated; the earliest date found is 1863, for the Old Testament History in the Slave language; the Cree-French-Blackfoot dictionary antedates Lacombe's Cree-French dictionary (1872), and the Sioux (Assiniboine)-French dictionary is dated 1875–1880.

It will be noted that these MSS deal with four different families of Indian languages: (1) Algonquian—Cree, Blackfoot, and a wider comparative study; (2) Athabascan—Montagnais, Slave; (3) Sioux—Assiniboine; (4) Koluschan—Thlingit.

The value to scholars of such works written by men who were in daily contact with these Indians and were expert in the use of their languages is inestimable, as I am informed by students in this field. Beside the linguistic forms recorded, there is a great deal of ethnological information to be gleaned from them.

The number of pages totals 2930, in different formats from 4×5 to 8×16 inches.

ROBLEY D. EVANS, Massachusetts Institute of Technology

Grant No. 373 (1939). Completion of the third international interchecking project on radioactivity.

The international program of calibration and standardization has made considerable progress during the past year despite com-

plications resulting from the war. Certified gamma-ray standards covering the range from 0.1 to 100 micrograms of radium have been completed and are now being distributed by the National Bureau of Standards. Dilute emanation standards containing 10^{-9} and 10^{-11} grams of radium together with certified blank rinsing solutions are also available through this agency. Progress has been made in the preparation of the thorium and beta-ray standards, and these will probably be ready for distribution during the coming year. In the meantime tentative beta-ray standards have been supplied to a few laboratories.

A number of intercheck radioactivity measurements have been completed with other laboratories in this country and abroad. Major revisions are now being made in the published work on terrestrial radioactivity from some of these laboratories.

A vigorous and searching discussion of the techniques and standards used in radioactivity measurements was the subject of one of the sessions at the recent Conference on Applied Nuclear Physics.

In collaboration with Dr. C. M. Alter, new measurements are being undertaken, by three independent methods, of the absolute value of the curie unit. The curie is the fundamental unit in which all radioactivities are expressed, but an uncertainty of about 6 per cent exists in its absolute value.

EVANS, R. D., 1941 (with GOODMAN, C.). Radioactivity of Rocks. Bull. Geol. Soc. Amer. (In press.)

GOODMAN, C., 1940 (with EVANS, R. D.). Progress Report on Radioactive Standards. Phys. Rev. 57: 557 (A).

A general announcement concerning radioactive standards appeared in some thirty American and foreign journals.

MALCOLM F. FARLEY,† Chicago, Illinois

(Formerly of Fukien Christian University, Foochow, China)

Grant No. 430 (1940). Studies in the archaeology and culture of China and particularly of Fukien and the South China Coast.

For fifteen years, from 1922–1937, as a member of the faculty of Fukien Christian University in Foochow, I devoted my spare time to a study of Chinese culture and archaeology and particularly to the culture and archaeology of the little-known areas of Fukien

† Deceased February 1, 1941.

and the South China Coast, an almost entirely uninvestigated and virgin field of research.

During the past three years I have given my full time to a continuation of this research in Europe, the Near East, and in America. An outline of part of the results of two years of this time was given in my report in the YEAR BOOK of the American Philosophical Society for 1939, pp. 203–206. I have continued this research and writing at Field Museum, Chicago, during the past year, working on six additional studies on the archaeology of China and the South China Coast. The first draft of five of these studies has now been completed, one study has been published in somewhat abridged form, two are under consideration for publication, and the other will be ready for publication by the end of the year.

A brief résumé of the contents of each of these studies follows:

1. The Study of an Extensive Early Kiln-site in South China and Its Part in China's World Ceramic Trade from the Ports of Fukien with the Near East.

The title of this study is self-explanatory; it was published in slightly abridged form in *Asia* for September 1939 as "An Ancient Chinese Kiln-Site." For many centuries, notably from the late 9th century to the 14th century, much of the world's most important trade was carried on between the Arab ports of the Near East and the ports of Southern China. Some of the chief of these were in Southern Fukien, notably about the time of Marco Polo, 1292 A.D. One of the major objects of export was Chinese porcelain.

It has been my purpose to discover and investigate the ancient ceramic centers in China which produced the wares exported, to investigate the ports and centers of this export trade along the South China Coast, and to find in the Near East the ports and *entrepôts* which particularly carried on this trade with China.

In this study I have described the discovery and the investigation of one of the most extensive kiln-site centers of this ancient ceramic trade and ceramic manufactory in South China and have indicated something of its importance in China's own trade and in her world ceramic trade. Wares from this center I found not only extensively distributed in China proper but as far afield as the desert ruins of Old Basra on the Persian Gulf where they had lain since Sung Dynasty times, 960–1280 A.D.

2. Contributions Towards a History of Ceramics in Fukien and South China: the History and Manufacture of Foochow "Blanc de Chine" and Other Imitations of Tê-hua "Blanc de Chine."

For more than a thousand years China has been the world's largest and most important manufacturer of porcelain. For eight hundred years of this time she was the world's only manufacturer of hard porcelain. For the past six hundred years most of this tremendous output of porcelain has come from one great ceramic center in China, the great Imperial center of Ching-tê Chên in Kiangsi province.

Only one other porcelain manufacturing center in China has challenged this unique monopoly during a period of almost six hundred years. This center is Tê-hua in Southern Fukien, the unique manufactory of white wares. Over a period of four or five centuries these wares have gained a unique and universal reputation in Europe and in China as perhaps the finest white art porcelain ever to be manufactured anywhere in the world. With such a high reputation, these wares have always seemed to be rare and scarce, even in China. Thus other lesser centers usually manufacturing inferior wares have tried to compete with the unique ware of Tê-hua. One of these has been a totally unknown center—the capital city of Foochow in Fukien.

This short but comprehensive study recounts the situation which I have briefly indicated, gives the history of the Foochow manufactory in so far as I have been able to work it out, and describes carefully its products and some half a dozen other imitations of this world-famous and important white porcelain of Tê-hua in Fukien.

3. The Methods and Materials of the Fukien Potter with Special Reference to Fukien Chien Ware of the Sung Dynasty.

Fukien "Chien" ware, the world-famous *temmoku* of the Japanese, has gained a world reputation among students and specialists in Chinese ceramics. Centuries ago this ware gained a not less high reputation in the Orient—in China and Japan—as the tea-ware *sans pareil* whether for private use or for the refined "ceremony of tea drinking" which became a cult in Japan and continues to be so to this day. Much in the way of praise and some little

in the way of description has been written about this ware in standard works on Chinese ceramics; much less of a technical and archaeological character.

In the long study under consideration, besides the historical sketch, this famous ware is considered in detail from both the archaeological and technical ceramic point of view and is made the center around which is given a relatively comprehensive study of the methods and materials, ancient and present-day, of the Chinese potter in Fukien.

4. Contributions to the Archaeology of Fukien and the South China Coast: an Investigation of an Ancient Center of Metal Working and Bronze Casting, a Mirror Manufactory of Kien-ning Fu in Fukien.

In my report in this YEAR BOOK for 1939, pp. 204–205, I discussed something of the importance which bronze mirrors hold in the study of China's ancient bronze culture and the civilization which it represents. Almost nothing to date is known of the early bronze culture of the South China coastal areas between Hangchow Bay and the colony of Hong Kong. Almost as little is known of the use of bronze in daily life in the later dynasties of T'ang (618–906 A.D.) and Sung (960–1280 A.D.). Nothing at all has heretofore been known about southern centers of bronze casting.

This study investigates the activity of the ancient inland center of Kien-ning Fu in north-central Fukien. Kien-ning Fu was an important trade center and an important city in Marco Polo's time when he visited it about the year 1292 A.D. just before his departure from China. A careful study of a Sung mirror bearing the Kien-ning Fu place-name serves as the basis for an investigation of this center as the probable seat of an important ancient metal craftsmanship. Another similar mirror, almost certainly from the same manufactory, and still others closely related are critically studied and compared. This study should prove of value as an account of the first center of mirror casting in South China to be investigated.

5. A Study of Ancient Chinese Iron Mirrors.

So far as I know, no study of this important phase of the ancient Chinese mirror craft has ever been made. In this brief but comprehensive study I have given a short history of Chinese iron mirrors as they are known from Chinese literary sources and have

followed this with a careful study of all the best-known specimens in Western collections, in so far as they have been available. These include four specimens in my own collection and those of my friends in China collected during fifteen years' search for these excessively rare specimens during which time I examined some twenty thousand mirrors. This study should fill a gap in this important branch of Chinese archaeology.

6. A Study of a Unique Lacquer-Covered Mirror from Fukien Excavations and a Comparative Study of Related Mirror Types and Techniques.

This investigation, like the previous one on iron mirrors, presents a first study specifically devoted to an important group of Chinese mirrors of unique type and technique, those covered with lacquer and various types of lacquer inlay. It is based upon a unique specimen from Fukien excavations, unique not only in Fukien but among all known specimens of Chinese mirrors. It thus forms an important background for a comprehensive comparative study of mirrors of this and related types and techniques. The find of such a mirror in Fukien excavations is equally important for the cultural relations and contacts of this—in ancient times—remote part of the Chinese Empire. The mirror dates from the T'ang Dynasty, 618–906 A.D.

Besides these six studies, especially mentioned in my application for a grant-in-aid, I have completed a short study of finds of Chinese ceramics in Greece, based upon my investigations there and in the Near East carried out during the spring of 1938, which is entitled "A Ming Stem-Cup from the Island of Scópelos and Other Finds of Chinese Ceramics in Greece and the Greek Islands." The title is explanatory of the contents of the article. It may be added that, so far as I know, this is the first written report of finds of early Chinese porcelain in Greece.

A study prepared under last year's grant was read before the Oriental Ceramic Society (of England) at their March meeting and was accepted for publication in the *Transactions* of that Society for the year 1938–1939. It is possible that the air raids on London have interfered with the progress of this enterprise as of so many others. The study was called "Red Tê-Hua" and is a study of a phase in the history of the manufacture of the world-famous ceramic center of Tê-hua in South Fukien, already mentioned in

this report in section 2. This study is intended to add another chapter to the history of this important porcelain center.

Finally, I may mention a study, not previously referred to, which is now under way: "A Handbook of the White Wares of Fukien and the South China Coast." The porcelain manufacture of the south coastal province of Fukien has been second in importance to that of the great Imperial center of Ching-tê Chên in Kiangsi. Moreover, for hundreds of years much of China's important ceramic trade was carried on from Fukien ports and much of the porcelain traded was of Fukien manufacture. Among these wares white porcelain held an outstanding position and gained a world-wide reputation. But to date no study of consequence has ever been devoted to the wares of Fukien. This handbook is a first classification, identification, and study of the important white wares of Fukien, wares which have played an important part in China's world ceramic trade for almost a thousand years and which today adorn the shelves of almost every important public and private collection of Chinese ceramics in the world. The first draft of this handbook is now practically complete and work on it will continue during the coming months.

In closing this report I wish to express again my deep gratitude to the American Philosophical Society for their continued support which has made possible the preparation and the continuation of these studies concerning the culture and history of this little-known, yet strategic and important, area of the South China Coast.

FARLEY, MALCOLM F., 1939. Fukien—China's Rich New Field for Archeology. A Summary Report of Sixteen Years of Archeological Exploration and Discovery in Fukien, China, and Along the South China Coast. Asia, November, 1939: 640–646.

—— 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 203–206.

—— 1940. Some Mirrors of Supposed Pre-Han Date. Harvard Jour. of Asiatic Studies 5, 1: 72–94.

—— 1940. Fukien—China's Rich New Field for Archeology. *Reprinted* in the Hamline Review 30, 1: 1–12.

—— 1940. The same, translated into Chinese and published in the Jour. of Fukien Culture, Shaowu, China: Apr., 1940.

—— 1940. An Ancient Chinese Kiln-Site. From Chachowfu and Other, Still Undiscovered, Ceramic Centers of South China Came the Wares Sent by Ship and Caravan Throughout the Known World of Marco Polo's Time. Asia, September, 1940: 453; 496–501.

—— 1940. Red Tê-hua. A New Chapter in the History of Chinese Ceramics and the Ceramic History of Fukien and the South China Coast. (Paper read before the Oriental Ceramic Society (of London) in March, 1940. Scheduled for publication in the Transactions of the Society for 1938–1939. Supposedly in press.)

MERRITT L. FERNALD, Gray Herbarium, Harvard University

Grant No. 394 (1940). Studies of estuarine, marsh and sand-plain floras of eastern Virginia and North Carolina.

Field-work was carried on in southeastern Virginia in five periods of one to three weeks each from April to September, 1940. During August and September, when the estuary-flora was mature all daylight periods of low tide were devoted to the estuaries; and, although the unprecedented freshets of mid-August seriously disturbed the work at the most promising period of the year, important new results were obtained in the discovery of additional pantropical species or those of interrupted but semicosmopolitan range in warm regions. In one case a species, previously known only in southern Eurasia and Africa but with "preglacial" fossils in England, which had been reported in the Americas only from fresh tidal flats of the Hudson, was found to be characteristic of fresh tidal streams entering York River. Others, characteristic of fresh tidal flats of New England or eastern Canada, were also found.

Since these peculiar plants are intolerant of great salinity of water and their austral and pantropical relationship indicates dispersal when relations of land and sea were quite unlike the present, the occurrence of some of these highly selective types north of the Chesapeake drainage, and especially in the Hudson and the rivers of New England and eastern Canada, calls for a migration when a continuous fresh to but slightly brackish condition prevailed along the coast from the off-shore bars of the Carolinas and southeastern Virginia to the Gulf of St. Lawrence. This condition prevailed before the submergence of the northern half of the Atlantic coastal plain (the continental shelf). Then, with continuous outer ridges and bars, comparable with those which prevail today off Pamlico Sound, Albemarle Sound and Back Bay in North Carolina and Virginia, the land-locked inner sounds would have given the ideal conditions for spread north and south of plants of fresh tidal waters. Accompanying the submergence of the northern half of the coastal plain the influx of seawater broke the ranges of the

flora of fresh tidal shores of the northeastern states and eastern Canada into isolated colonies which found refuge in fresh tidal reaches of remote rivers. If, as is generally believed, the submergence was pre-Wisconsin, then the persistence of these isolated relics of an older migration within the areas of Wisconsin glaciation adds further evidence that, in special habitats, life was not extinguished by the Wisconsin.

During periods of high tide and when the estuaries were inaccessible further explorations above tidal-level resulted in the discovery of 75 species of flowering plants not previously known from Virginia. Insofar as the results were worked up they are included in the following paper. Other conclusions must await more detailed study of the material.

FERNALD, M. L. A Century of Additions to the Flora of Virginia. Rhodora 42: 355–416, 419–498, 503–521. (Contributions from the Gray Herbarium of Harvard University, CXXXIII.)—Especially Part III. The Flora of Fresh Tidal Estuaries and Shores, pp. 504–521.

M. BRUCE FISHER, Rhode Island State College

Grants No. 338 (1939) and 479 (1940). Studies in the effect of the surrounding field on critical flicker frequency in the fovea.

One part of the research program has been completed. Critical flicker frequency was measured by the method of limits in a 2° foveal area, of 5.8 c/m² brightness, viewed monocularly through a 2 mm. pupil. Two surrounding fields were used; a circular area of 42° diameter, with the test area at its center; and an annulus, of 12° radial width, concentric with the test area and separated from it by an 8° dark space. Both surrounding fields were used with brightnesses of 103 and 1030 c/m².

During each experimental session threshold measures were made continuously in four 16-minute periods, each preceded by dark adaptation. Half of the forty-eight liminal readings secured in each period were made with the surrounds illuminated; half, with the surrounds dark. In one period the surrounds illumination was on for four minutes, then off, on, and off for the three following four minute intervals. In the other three periods the alternation intervals were two minutes, one minute, and twenty seconds.

Each surrounding field was used at both brightnesses and each procedure was repeated in another session with the order of the alternation intervals reversed. There were two subjects.

The differences between the paired limens, obtained with and without surrounds in each 16-minute period, are the significant data of the experiment. For all surrounds and illumination conditions, they show a gradient of increasing difference between the limens with increasing length of the alternation period.

These results, together with supplementary data secured by a different procedure, cannot be completely accounted for by any known mechanism in the optic nervous system. Rather, they are considered as critical evidence for the "V-substance" hypothesis, previously proposed, according to which some primary or secondary product of the initial photosensory reaction may pass to and increase the "reactility" of distant areas in the retina.

Studies of the effect of the size of the surrounding field on foveal flicker frequency, and of the effect of the distance of a large field from the tested area are not yet complete, but the indications are that they will confirm other data previously secured with acuity as the tested function.

ROY PHILIP FORSTER, Dartmouth College

Grant No. 457 (1940). Comparison of renal function in fresh-water fish and amphibians with that in the marine fish: the glucose reabsorptive process in the frog renal tubule; evidence for glomerular functional intermittency in the normal intact animal.

In this series of experiments on fifteen bullfrogs, 150 simultaneous inulin and glucose renal clearance determinations were made with the glucose plasma concentrations ranging from 41 to 1650 mg-%, and the urine flows from 1 to 35 ml/kg/hr. The inulin clearance (occasionally creatinine clearance) was used to measure the rate of glomerular filtration, and the physiological and biochemical procedures were the same as those employed in an earlier study.[1]

The amount of glucose reabsorbed by the renal tubule cells (T_G) was found to be influenced both by the simultaneous glucose plasma concentration and the rate of urine flow. This value was calculated from the formula,

$$T_G = P_G\, C_{IN} - U_G\, V,$$

where P_G and U_G are the concentrations of glucose per ml of plasma and urine, respectively, C_{IN} is the inulin clearance and V is the urine flow in ml/kg/hr.

[1] Forster, Roy Ph. Jour. Cell. and Comp. Physiol., 12: 213 (1938).

As the glucose concentration is raised in the plasma the amount of glucose reabsorbed by the tubule cells increases until a maximum is reached at a plasma concentration of 300 mg-%. This average reabsorption maximum (glucose T_m) is 1.16 mg/ml of glomerular filtrate formed, and is a constant value for all glucose plasma concentrations over 300 mg-%. This indicates that there is a maximal limit imposed upon the tubular mechanism responsible for the reabsorption of glucose.

However, despite the average constant glucose T_m, at plasma concentrations over 300 mg-% the amount of glucose reabsorbed during any individual clearance period varies directly with the simultaneous rate of urine flow or the rate of glomerular filtration. It was demonstrated earlier that in the frog, unlike mammals, variations in urine flow are produced primarily by alterations in the rate of glomerular filtration rather than by differential rates of tubular water reabsorption.[1] An average of 8 mg of glucose are reabsorbed per kg/hr at a rate of glomerular filtration of 5 ml/kg/hr, and this rises to 32 mg at 20 ml, and 64 mg at 40 ml. This direct correlation between the rate of glomerular filtration and the rate of glucose reabsorption, when the glucose plasma level is higher than 300 mg-%, is interpreted as indicating that variations in glomerular filtration rate are caused by the opening and closing of the individual glomeruli, which in turn determines whether or not their associated renal tubules will have available glucose for reabsorption.

Glomerular functional intermittency has not been indicated in mammals by these variations in the rate of glucose reabsorption.[1] These current results on the frog by the clearance technique substantiate the earlier findings of Richards and Schmidt,[2] who directly observed the intermittent opening and closing of glomeruli in the exposed frog's kidney.

SIMON FREED, University of Chicago

Grant No. 408 (1940). Study of the structures of the electric fields about ions in solutions and their relations to chemical thermodynamics.

1. We investigated the influence of the magnetic field on the sharp spectra of europium ions in solutions. This was undertaken

[1] Goldring, William, Herbert Chasis, Hilmert A. Ranges and Homer W. Smith. J. Clin. Invest. 19: 739 (1940).
[2] Richards, A. N., and C. F. Schmidt. Am. J. Physiol. 71: 178 (1924).

in the program of deriving the symmetries and the intensities of the fields of the environment about the ions.

It turned out that the spectra were sharp enough to obtain Zeeman Effects from certain solutions, the first instances of such an effect from the liquid state. The lines resulting from the fields of the environment were further split by the external magnetic field. Some of the new lines were found polarized both in the longitudinal and in the transverse effects.

2. A series of experiments was carried out to extend our knowledge of the phenomenon discovered last year with aid from the Penrose Fund, namely, quasi-lattice oscillations in liquids. Besides acquiring additional manifestations of this phenomenon and obtaining quantitative data, the intention was to secure a broader and more certain basis for the interpretations. Our point of view was found confirmed.

3. All the spectroscopic investigations of solutions and of crystals have presupposed the validity of the theory of H. Bethe (1929) concerning the number of components into which electronic levels will be split by fields of various symmetries. We found it possible to subject the theoretical predictions to an experimental test. This was done by providing two widely different symmetries about the europium ion, originating however in both instances from identical negative ions in the first coordination zone and from very similar ions in the more remote coordination zones. The spectra as affected by the fields of the different symmetries were found in quantitative agreement with the theory.

4. Because of the sharpness of their spectra, the ions of europium may be employed as spectroscopic indicators for the symmetry and eventually for the intensity of the electric fields of their environment in solution as well as in crystals.

The spectra of some chelate coordination compounds are described and from these are derived the symmetries of the fields about the central ions. The symmetry of the effective fields about the ions in solution differs from that in the crystal.

The process of dimerization of the acetylacetonates of europium and of the dissociation of the dimers can be readily followed spectroscopically.

Both the dimers and the monomers exist in two stereo-isomeric forms. While the structures of the two dimeric forms are easily accounted for in terms of previous work on coordination compounds,

the existence of the two isomers of the monomer brings new isomeric distinctions into this domain of chemistry.

The compounds investigated are those in which one europium ion replaces the active hydrogens of three identical diketones and remains in first coordination with the oxygen atoms of the resulting substituents. The following diketones are employed: acetylacetone (pentane dione 1,4), symmetrical methyl acetylacetone (3 methyl pentane dione 2,4) and benzoylacetone (1 phenyl pentane dione 2,4). A similar compound is formed with salicyl aldehyde. The following serve as solvents: benzene, carbon tetrachloride, and chloroform.

FREED, S., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 209.

—— 1940 (with WEISSMAN, S. I., and ROTARIU, G. I.). Zeeman Effect from Liquids, Solutions of Salts of Europium. Jour. Chem. Phys. 8: 291.

—— 1940 (with WEISSMAN, S. I.). Lattice Vibrations in Crystals and the Corresponding Vibrations of Their Solutions, II. Jour. Chem. Phys. 8: 840.

—— 1940 (with WEISSMAN, S. I.). Verification of the Theoretical Numbers of Components into Which Electronic Energy Levels are Decomposed by Crystal Fields. Jour. Chem. Phys. 8: 878.

—— 1941 (with WEISSMAN, S. I., and FORTESS, F. E.). The Absorption Spectra of Ions of Europium and the Electric Fields Within Some Coordination Compounds. Jour. Amer. Chem. Soc. for March.

HARRY B. FRIEDGOOD, Harvard Medical School

Grant No. 333 (1939). Biochemical study of hirsutism and virilism in women.

A. Studies in collaboration with Doctors Louis F. Fieser and John K. Wolfe, Converse Memorial Laboratory, Harvard University, Cambridge.

1. Isolation and chemical identification of four androgens from the urine of a patient with virilism due to malignant cortico-adrenal tumor. These crystalline androgens are androsterone, dehydroisoandrosterone, aetiocholane-3(α)-ol-17-one, $\Delta^{3,5}$-androstadiene-one-17.

B. Investigations in the Endocrine Assay Laboratory of the Peter Bent Brigham Hospital.

1. A colorimetric method based on Zimmermann's reaction has been perfected for the quantitative assay of urinary ketosteroids.

The clinical usefulness of this method as a guide to the androgen content of the urine of patients with various endocrinopathies is possible because of the following circumstances:

a) The urinary androgenic substances are ketosteroids which have in common a cyclopentanophenanthrene ring nucleus.

b) These urinary ketosteroids can be separated nearly quantitatively from other ketonic substances in the urine during their extraction and purification by the method of Gallagher and Koch.

c) The androgenic activity of the urine is limited to the neutral fraction of the extract which contains these ketosteroids.

d) The depth of color developed by the interaction of ketosteroids and m-dinitrobenzene in the Zimmermann reaction is proportional to the ketosteroid content of the extract, so that the intensity of color is a measure of the ketosteroid content of the extract.

e) In an extensive study of urine extracts the Callows have found that there is a statistically significant correlation between the results of bioassay and colorimetric assay methods.

2. Extraction, purification, and assay of the urinary ketosteroids have been carried out in numerous patients. The average daily excretion in ten normal young adult women ranged from 6.2 to 18.9 mg.-equivalents androsterone per 24 hours in 69 specimens (mean = 12.4); in twenty-five cases of hirsutism without virilism, from 2.8 to 18.9 in 185 specimens (mean = 12.5); in eighteen cases of virilism not due to cortico-adrenal tumor, from 4.3 to 43.2 in 132 specimens (mean = 20.1); in two cases of virilism due to cortico-adrenal tumor, 36.3 to 126.5 in 17 specimens (mean = 65.5); and in one case of Addison's disease, 2.5 to 5.5 in 12 specimens (mean = 3.8). Approximately half of these determinations were done during the past year while the grant from The American Philosophical Society was in effect. The other half were done the preceding year.

Removal of a cortico-adrenal tumor from a patient who had no metastases precipitated a 95.5 per cent decrease in ketosteroid excretion (66.2 to 4.9) within 48 hours. A similar operation in a patient with metastases was followed by an increase in urinary ketosteroids (54.1 to 126.5). The ketosteroid content of the urine began to increase about four months before clinical evidence of metastasis was available in the first of these two cases.

Bilateral gonadectomy in a patient with virilism not due to tumor induced a 25 per cent decrease (43.2 to 32.4) which began in 72 hours and lasted several months. By the eleventh month her ketosteroid output had increased 49 per cent (32.4 to 56.8), at which point unilateral adrenalectomy induced a 50 per cent decrease (56.8 to 27.3) within 48 hours.

The conclusions derived from these studies are as follows:

a) The range of ketosteroid excretion for normals and the hirsutism-virilism group overlap, although the virilistic patients tend to have higher levels. Excessively high values occur in the virilism-tumor group and in infrequent cases of virilism without tumor. The determination of total daily urinary androgen excretion is therefore of limited but definite value in the differential diagnosis of virilism, and it may also have prognostic significance.

b) Ketosteroids continue to be excreted in moderately diminished amounts by the female after bilateral gonadectomy. The Callows have demonstrated the same for male eunuchs; and Hirschman has found that the androsterone, dehydroisoandrosterone and aetiocholane-3(α)-ol-17-one content of castrate urine is only slightly less than that of normal urine. This is evidence that the ovaries secrete androgens (ketosteroids) and that there is an extragonadal source for these substances. The abnormally high amounts of ketosteroids excreted by patients with virilism due to adrenocortical tumor or to the adrenogenital syndrome focuses attention on the adrenal cortex as an important extragonadal source of androgens.

c) The fact that unilateral adrenalectomy in a gonadectomized virilistic female resulted in a 50 per cent decrease of the urinary ketosteroids indicates that in this patient the adrenals were supplying essentially all of the ketosteroid content of the urine. The changes in ketosteroid and presumably androgen excretion which were observed in the two tumor cases also indicate that the major portion of their urinary ketosteroids originated in cortico-adrenal tissue. The abnormally low values in Addison's disease support this conclusion.

d) The gonadotropic activity of the anterior pituitary is known to increase after castration. Since the pituitary is also known to have an adrenotropic effect, it is possible that the progressive rise in androgen excretion, during the months fol-

lowing gonadectomy, is induced through the adrenal cortex by way of the anterior pituitary gland.

3. Extensive studies have been completed on certain aspects of the chemistry of Zimmermann's m-dinitrobenzene reaction. It has been demonstrated that the water content of the reaction mixture is of primary importance. The most accurate results are obtained if the chemical reaction is carried out in absolute alcohol; the presence of even minute amounts of water interferes with the reliability of this chemical method.

Friedgood, Harry B., 1940. Effect of Water on the Accuracy of the M-Dinitrobenzene Reaction in the Quantitative Assay of Urinary Ketosteroids. Endocrinology, 28: 248.
—— 1941. Urinary Androgen Excretion in Relation to Gonadal and Corticoadrenal Function. Endocrinology. (In press.)
—— 1941 (with Wolfe, J. K., and Fieser, L. F.). Nature of the Androgens in Female Adrenal Tumor Urine. Jour. Amer. Chem. Soc. 63: 582.

Robert Gaunt, New York University

Grant No. 343 (1939). The rôle of steroid hormones in carbohydrate metabolism; adrenal insufficiency in the ferret and its response to cortical and other steroid hormones; and related investigations.

1. It is known that adrenal cortical extract and some crystalline compounds obtained from the adrenal cortex exert a marked and rapid diabetogenic effect on animals wholly or partially depancreatized. This action was confirmed in ferrets made diabetic by sub-total pancreatectomy. As in other species these animals were even more responsive to the diabetogenic action of crude pituitary extracts than to cortin.

The action of various other steroids on the glycemia, glycosuria and acetonuria of diabetic ferrets has also been studied. Desoxycorticosterone, a substance highly active in maintaining life in adrenalectomized animals, had no consistent effect on diabetic symptoms (5–10 mg. per day for 4–9 days in eight cases). This confirms various other findings indicating that the diabetogenic action of cortin cannot be attributed to this compound. Progesterone (10–25 mg. per day for 6–12 days in five cases) likewise was without significant effect.

Estrogens (various esters of estradiol, 1–3 mg. per day for 9–16 days in six cases) which usually have been found to alleviate dia-

betic symptoms, had, if anything, the opposite effect in our cases. In two cases there was an initial drop in glycosuria, but this was only transitory and the over-all mean effect was a 35 per cent increase in sugar excretion and an enhancement of acetonuria in every case. High variability made the significance of the rise in sugar excretion questionable but the absence of the expected depression of glycosuria was clear. The results with testosterone propionate (15–20 mg. in four cases for 9 days) suggested a slight diabetogenic response.

2. The synthetic substance pregneninolone (anhydro-oxy-progesterone) has to some extent the biological properties of androgens, estrogens and progesterone. It is used largely because of its progesterone-like action when given orally. Tests were made in adrenalectomized ferrets and rats to determine if pregneninolone shared the cortin-like activity of progesterone. These experiments indicated that, like the estrogens, pregneninolone may have caused some retention of electrolyte and water, but if anything, reduced rather than extended the life-span of adrenalectomized animals.

In the course of this work the marked toxicity of propylene glycol, often used as a solvent for steroid hormones, was revealed in adrenalectomized animals.

3. A comprehensive study was made of the lactation-inhibiting effects of the following endocrine agents: chorionic gonadotropin, pregnant mare serum, estrogens and androgens. It was concluded, contrary to some earlier reports, that this action of gonadotropins was entirely through the ovary. A gonadotropin-stimulated ovary inhibited lactation more effectively than could be done by any dose or combination of steroid hormones which we were able to give to ovariectomized mothers. Furthermore, the lactation-inhibiting properties of estrogen were greatly enhanced in the presence of ovaries. The theoretical implications of these facts are discussed in the paper in press.

GAUNT, R., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 213–216.

EVERSOLE, W. J., 1940 (with EDELMANN, A., and GAUNT, R.). Effect of Adrenal Cortical Transplants on Life-Maintenance and "Water Intoxication." Anat. Rec. 76: 271.

EDELMANN, A., 1940 (with GAUNT, R.). Inhibition of Lactation in the Rat. Proc. Amer. Physiol. Soc., p. 54.

—— 1941 (with GAUNT, R.). Inhibition of Lactation in the Rat. Physiol. Zool. (In press.)

GAUNT, R., 1941. Effect of Pregneninolone and Propylene Glycol on Adrenalectomized Animals. Anat. Rec. (Suppl.) 78: 151.
—— 1941 (with DOLIN, G., and JOSEPH, S.). Steroid Hormones in Experimental Diabetes Mellitus of Ferrets. Anat. Rec. (Suppl.) 78: 90.
DOLIN, G., 1941 (with JOSEPH, S., and GAUNT, R.). Effect of Steroid and Pituitary Hormones on Experimental Diabetes Mellitus of Ferrets. Endocrinology. (In press.)

LOUIS D. GOODFELLOW, Northwestern University

Grant No. 460 (1940). Statistical technique for controlling the effects of certain subjective factors on psychological data.

The purpose of this study has been to determine how extensive the tendencies are on the part of individuals to follow certain definite patterns in making psycho-physical judgments and to analyze further the nature of these patterns in an effort to determine the psychological bases for them.

The present method of attack is to analyze student responses on true-false examinations which have been prepared in very specific ways. For example, an obviously true or false question is followed by a number of frequently-missed questions in order to study the effect of the obvious question on the following questions where guessing is a large factor. In order to counteract the effects of guessing and definite knowledge of the question, alternate forms of the test are used, one of which starts off with an obviously true question, the other with an obviously false one.

The following tendencies on the part of students are suspected of producing the observed pattern effects and are therefore being analyzed to determine the extent of their influence. They are:

1. Tendency to favor one response over another because of mental-set created by instructions directly given or implied by the nature of the test.
2. Tendency to change response due to previous response.
3. Tendency to arrange responses in an asymmetrical series due to popular misconception of probability.

To date we have no results available. A number of true-false examinations have been prepared and tried out on small classes for the purpose of validating the techniques. After arriving at a satisfactory form a large battery of tests have been worked out and given to approximately 500 students. These tests are now being scored.

WOLFGANG HALLGARTEN, University of California

Grant No. 433 (1940). Investigation of the changes in the ideological and socio-economic structure of imperialism, 1870–1940.

The main results of research work done in 1940 are summarized as follows:

1. *Changes in the ideological structure:*

The period of "classical" imperialism, starting in the early 1870's, and the period of "super"-imperialism, beginning in the late 1920's, were both inaugurated by a world-wide economic depression which shattered the ruling society of most civilized nations and made it inclined towards political expansion in order to delay its final breakdown. This process was prepared, in the field of ideology, by "re-feudalization," i.e., by a preaching of aristocratic ideals intended to prevent the lower classes from seizing control and to deflect them from their political aims, a development which squared, at the same time, with the economic interests and aims of modern capitalism. Standard-bearers of "re-feudalization" were mostly renegades coming from "below": middle-class apostates in the 19th and renegades from the lowest classes in the 20th Centuries. Common origin of the neo-aristocratic doctrines is the Romantic ideology, developed in the fight of feudal and monarchic Europe against the French Revolution. Yet the fate of these ideas varied according to the evolution of the individual nations. In England, their development was hampered by the lack of a military aristocracy and of bureaucratic centralism. Faced with after-War nationalism in most parts of the Empire, British imperialism, in the last 20 years, practically enlarged the limits of the neo-aristocratic Empire-community as preached by Carlyle and Dilke, etc., and permitted the suppressed races to rise. In Italy, the neo-aristocratic doctrines underwent a decisive transformation according to the requirements of the after-War world, pressed by social revolutions. Yet as Mussolini did comparatively little in the way of changing the existing social order his ideology lacked that kind of support among the Italians which it found in Germany, during and after the decline of the middle class. In the ranks of this dispossessed stratum neo-aristocratism could develop into that new religion, the "racial" idea. Ruined by the loss of the War but, still more, by the development of monopoly-capitalism this class was the only one, in the ranks of the international bour-

geoisie, to identify itself completely with militarism and with anti-Semitism which reflects, on an enlarged scale, the aversion of Germany's feudal war lords, the junkers, against the "commercial" world, the "commercialized" British aristocracy included.

2. *Changes in the social structure:*

In the era of Fascism, the "unorganized" imperialism of the "classical" period (1870–1914) develops into an organized system. With the economic monopolies—main acting forces behind the screen of "classical" imperialism—becoming dependent upon state-orders, the imperialist evolution loses the blind, anarchic character it possessed before 1914 when the interests of capitalistic groups directly interfered with power-politics. After 1929 the state, obedient servant of the economic forces in the preceding period, becomes the latters' master. Hence the monopolies' anxiety to prevent the state from slipping into socialist hands as well as their helplessness in front of the absolutistic policy of the Fascist mass-leaders. Under the heading "Wehrwirtschaft"—war economics—the middle class in Germany, the victim of monetary inflation, starts turning the tables and expropriates or, at least, strictly controls the monopolies. The former capitalists join the declined middle class in developing into a stratum of state-fed officials and "rentiers." At the same time, imperialism changes its character in the international field. Capital export is replaced by the barter system. "Economic bribes" in turn favor the winning over of national minorities in foreign countries and the establishment of an international network of helpers, fed by neo-aristocratic doctrines and known as "Fifth Columnists." While having something in common with "mercantilism" this new imperialism differs from the former by its serving as an outlet for an (artificially created) "over-population." Yet only a small sector of the "over-population" is turned into colonists and settlers. The biggest part is employed in "war-economy," a system still more unproductive in itself than the Fascist "colonization" and the burdens of which are to be borne by subjected nations and races. Thus, a neo-Spartan society is created. The response of the Western world to this type of Fascist imperialism was the break-down of "classical" imperialism even here and the development of new forms of life which appear to forecast a kind of Socialism. The Soviet Union's reaction to super-imperialism was an increase of dictatorship, to make up for the weakness in the international field caused

by its inner reconstruction. For the rest, the development of modern "super-imperialism" and of war economics in Europe has much in common with the development in Japan where the fight of a dispossessed stratum (Samurai), representative of ultra-militarism, against economic monopolies (Mitsui, Mitsubishi, etc.) is already a half century old.

HALLGARTEN, WOLFGANG, 1941. The Social Foundations of World War Strategy. (Accepted for publication by the Pacific Historical Review.)

—— From Imperialism to Super-Imperialism: a Genetic Study. (Manuscript ready for publication.)

THOMAS HALE HAM, Harvard Medical School

Grants No. 218 (1938), No. 315 (1939) and No. 407 (1940). Studies on the destruction of red blood cells.

Observations have been made concerning the mechanism of destruction of red blood cells following the administration of sulfanilamide. Four patients receiving this drug developed acute hemolytic anemia associated in three instances with severe hemoglobinemia and hemoglobinuria. In all four patients the red blood cells showed a transient but striking increase in their susceptibility to hemolysis in hypotonic solutions of sodium chloride. This increased fragility occurred at the period of maximum destruction of red cells. Serum from these patients did not contain any demonstrable hemolytic agents.

In collaboration with Dr. William B. Castle and Dr. Charles P. Emerson, it has been demonstrated *in vitro* that sulfanilamide itself does not cause an increase in the fragility of red blood cells. The possible breakdown products of sulfanilamide are being investigated. Two of these, para-aminophenol and hydroquinone, produce striking increase in the fragility of red cells *in vitro* and hydroquinone injected into cats produces a hemolytic anemia with the same features observed in the human subjects receiving sulfanilamide.

With Dr. Emerson, it has been shown that red blood cells subjected to stasis for two hours in the kidney, spleen and vena cava of the cat have an increased fragility in hypotonic solutions of sodium chloride.

In association with Dr. Henry H. Brewster and Dr. Castle, it has been demonstrated that red blood cells obtained from patients with the sickle cell trait show a striking increase in viscosity when in the sickle form. The viscosity increases as the partial pressure of

oxygen is decreased when such blood samples are equilibrated with various mixtures of oxygen and nitrogen in the presence of a constant amount of carbon dioxide. Because this increase in viscosity becomes manifest *in vitro* at about the oxygen tension of mixed venous blood it is probable that such increases in viscosity may occur in a patient with the sickle cell trait and produce a striking increase in stasis in the capillaries. This phenomenon may well account for the infarctions and increased destruction of red blood cells observed in certain of these patients.

HAM, THOMAS HALE, 1940 (with CASTLE, WILLIAM). Studies on Destruction of Red Blood Cells. Relationship of Increased Hypotonic Fragility and of Erythrostasis to the Mechanism of Hemolysis in Certain Anemias. Proc. Amer. Philos. Soc. 82: 411–419.

—— 1940 (with CASTLE, WILLIAM). Relation of Increased Hypotonic Fragility and of Erythrostasis to the Mechanism of Hemolysis in Certain Anemias. Trans. Assoc. Am. Phys. 55: 127–132.

—— 1940 (with CASTLE, WILLIAM). Mechanism of Hemolysis in Certain Anemias: Significance of Increased Hypotonic Fragility and of Erythrostasis. Jour. Clin. Invest. 19: 788.

MORRIS H. HARNLY and RUTH B. HOWLAND, Washington Square College, New York University

Grant No. 362 (1939). Analysis of the effect of the vestigial locus during the embryological and larval periods of Drosophila.

1. The variations of wing form and of wing function with temperature of eight genotypes of Drosophila melanogaster. (Morris H. Harnly.)

Tests on four genotypes that include a mutant allele at the vestigial locus demonstrate that the thermolabile period for wing form (including minor nicks) occurs during the larval stage only. This period falls in the stage of wing bud development in the dorsal mesothoracic disc. However, the thermolabile period of the extra cross-veins found in the wings of one of these genotypes is restricted to the pupal stage. Again the effective period agrees with that of structure formation. From the above and my previous work it is evident that the next step in the examination of wing gene action is a comparative study of wing bud development for several genotypes at a number of temperatures.

An analysis of four more genotypes demonstrates that the degree of wing margin nicking or notching, presence of two types of

extra cross-veins, incomplete V-vein, and a delta are not due to the allele at the vestigial locus. These characters could be shifted at will from one allele to another by the proper breeding procedure. Some of these characters are dependent on single loci, others (e.g. marginal nicks) are controlled by several loci. Some of them were expressed only at low temperatures, others only at high temperatures, while some varied in the degree of expression through the viable temperature range. All of the foregoing together with our previous work emphasize the necessity of rigid genetic control in any attempted examination of gene action during development.

The functional capacities of the wings on a number of genotypes have been examined. The phenotype of most of these varies with the temperature at which the individual develops. Such genotypes were reared at a number of temperatures. When the wings are normal or have only minor nicks at the distal end and are carried in the normal position the animals fly readily. With increasing marginal defects the flight becomes erratic. Marked marginal defects with the wings carried in the normal position during rest result in a combination of hop and erratic flutter when the animal rises from the desk. Animals with "strap" wings carried in the normal position at rest apparently move these wings when they hop but such movement has no apparent effect on their stay in the air. For phenotypes ranging from "strap" down to "vestigial" the genotypes vary markedly in their functional capacities. For example two genotypes differing sharply in their critical temperature produce identical "vestigial" wings at one point in their respective curves. This common phenotype can be readily and with certainty separated into the two genotypes by the marked difference in the functional capacity of these wing vestiges. Obviously we are dealing here with previously undescribed effects of the wing genes on the articulation of the wing with the thorax, or the muscles used in wing movement or their enervation, or some combination of the factors for functional capacity in D. melanogaster. Through the use of temperature it has been possible to differentiate between the effect of the gene on wing form and wing function (degree of capacity to move).

HARNLY, MORRIS H., 1940. Experiments Demonstrating no Pupal Critical Period for Wing Size and Form in Four Genotypes of D. melanogaster. Genetics 25: 120. (Abstract.)

2. Effects of centrifugation of early Drosophila eggs. (Ruth B. Howland.)

The eggs of D. melanogaster centrifuged for thirty minutes at 2400 R.P.M. are stratified into four zones. These are:

(*a*) Centrifugally, the heavy white material from the yolk spheres.
(*b*) Yolk spherules, released from their surrounding fluid areas.
(*c*) A broad granular zone, in which the egg nuclei (cleavage nuclei) lie and
(*d*) A pale non-granular cap, devoid of nuclei.

In addition, there is a layer of deeply staining ooplasm in which the so-called germ cell determinant lies. This shifts little, and if it moves at all, granules and cytoplasm move as a unit. Centrifuged nuclei may depart from the usual synchrony. Giant nuclei are common.

In preblastoderm stages, the cleavage nuclei, although as yet undivided from each other by cell walls, are not moved from their superficial positions in the cortical ooplasm. This must be due to an increase in the viscosity or an added rigidity of the cortical layer.

Larvae from centrifuged eggs hatch later than normal larvae. The younger the stage of centrifugation, the greater the delay in hatching time. Torsion or partial rotation along the long axis is observed in many cases. Puparia of twisted larvae are also rotated, in some instances as much as 180°.

Adults from centrifuged eggs may be normal in external appearance, but many show partial torsion of the abdomen; absence of the genital plates; inclusion of genital plates within the abdominal cavity or other abnormalities. It is suggested that these abnormalities occur as a result of diagonal or oblique extension of the germ band around posterior-lateral "yolk blocks" which are too tightly packed by centrifugation to be redistributed in the early embryonic stages.

HOWLAND, RUTH B., 1939 (with ALBAUM, H. G., and KAISER, S.). Effects of Early Centrifugation on Drosophila Eggs, Embryos, Larvae, Pupae and Adults. Anat. Rec. (Suppl.) 75: 112. (Abstract.)

G. P. Harnwell, University of Pennsylvania

Grant No. 260 (1938). Construction of a new type of beta-ray spectrograph to investigate the beta-ray spectra of electron-emitting and positron-emitting radio-elements.

This instrument is being used at present for the measurement of the energy of the conversion electrons from radio-manganese. The source was supplied by the Radiation Laboratory of the University of California at Berkeley. Inasmuch as the gamma ray energies for only a few artificial radioactive elements have been accurately measured through their conversion electron spectra it is hoped to investigate a number of other elements as sources become available. This work is being done photographically and the apparatus is calibrated by measuring the magnetic field. This calibration will be checked by a measurement of the position of the conversion electron spectrum of RaC.

The original project of adapting the secondary-electron multiplier to the measurement of the low energy region of beta-ray spectra has proven to be more difficult than was originally anticipated. This work is being continued by a second student who is designing a new multiplier to be used interchangeably with the present photographic recording fittings.

Harnwell, G. P., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 230.

Francis Harper, The John Bartram Association, Philadelphia

Grant No. 291 (1939). The preparation for publication, with adequate annotations, of John Bartram's manuscript diary of his journey through the Carolinas, Georgia, and Florida in 1765–66; of William Bartram's manuscript report to Dr. John Fothergill on his travels in the Carolinas, Georgia, and Florida in 1773–74; and of a new edition of William Bartram's "Travels" (1791).

The investigation begun and reported upon last year (Year Book, 1939, p. 231) has been steadily carried forward. Another field trip, lasting from February 26 to May 14 and extending through North and South Carolina, Georgia, and Florida, permitted a more thorough examination of the Bartram routes than had been possible during the reconnaissance trip of the previous year.

A considerable number of additional important Bartram localities were identified with certainty, and a few others tentatively. These include, in Florida, the sites of the Indian villages of Cuscowilla and Talahasochte, the "Alligator Hole," the "Halfway Pond," and numerous points along the St. John's River, including the shell mound where William Bartram reported the graves of the last remnant of the Yamasees annihilated by the Creeks. An important new locality in Georgia, at least tentatively identified during a tour of the Savannah Basin, is the "Flat Rock," a rendezvous for colonial traders west of Augusta.

The collections made during this trip include about 950 sheets of plants, numerous mollusks, and a moderate number of fishes and amphibians. Most of the plant specimens are due to the zeal of E. Perot Walker, of the Academy of Natural Sciences of Philadelphia, who accompanied me. Several of the fishes collected in 1939 and 1940 are being described as new by Henry W. Fowler, of the same institution; one of them, from a locality visited by John Bartram, is being named in his honor.

John Bartram's manuscript of 1765–66 and William Bartram's manuscript of 1773–74, each dealing with a journey through the Southeast, are now virtually ready for publication. The comments and annotations that have been prepared to accompany them cover more space than the original manuscripts.

Harper, Francis, 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 231.

—— 1940. Some Works of Bartram, Daudin, Latreille, and Sonnini, and their Bearing upon North American Herpetological Nomenclature. Am. Midl. Naturalist 23: 692–723.

Fowler, Henry W., 1941. A Collection of Fresh-water Fishes Obtained in Florida, 1939–1940, by Francis Harper. Proc. Acad. Nat. Sci. Philadelphia, 92: 227–244.

Emil W. Haury, University of Arizona

Grant No. 428 (1940). Excavation of a pre-Spanish village site on Forestdale Creek in the Ft. Apache Indian Reservation, Arizona.

The archaeological work carried on under this grant was a continuation of a project started in 1939 with Grant No. 299 from the American Philosophical Society. The immediate problems were (1) the establishment of the cultural pattern represented in a 7th century pithouse village of east-central Arizona; (2) the extent of

the influence exerted on its occupants by two of the principal Southwestern culture divisions—the Anasazi and the Mogollon; and (3) the establishment of an accurate chronological control through tree ring dating.

The excavations were conducted between June 15 and August 10, 1940, under a permit from the United States Department of the Interior and the Apache Tribal Council. The ruin is situated on the Ft. Apache Indian Reservation, approximately sixty miles south of Holbrook, Arizona.

During the time allotted for field work, nine domestic structures, one storage structure, and one large subterranean kiva were uncovered in the pithouse village, together with several deep earth ovens and twenty-six human burials. In addition, work was also begun on a stone pueblo at the edge of the pithouse village where twelve rooms and a Great Kiva, measuring 62 feet in diameter, were cleared. Adjoining the pueblo two pithouses were also excavated.

The dates derived from tree ring specimens uncovered in the houses showed the pithouse village to have been occupied in the 7th century A.D. and the pueblo to have been constructed in the early 12th century. For the two pithouses adjoining the pueblo, no tree ring dates were available, but the associated ceramic remains permit an assignment of the 8th or 9th century to these dwellings.

The houses of the earlier village bear the distinct stamp of two architectural styles, namely, Anasazi and Mogollon. House features of both were combined owing to the fact that the village was marginal geographically to the centers of these two groups.

The outstanding architectural feature of the site was the kiva, a below-surface structure measuring 36 feet in diameter and 6 feet in depth. It is significant in that it was the prototype of the Great Kiva in the pueblo which dated about 1100 A.D., thus demonstrating the continuity of this architectural trait through at least four centuries of time. The later of these two kivas is the first of its kind uncovered in Arizona and extends the distribution of Great Kivas 100 miles further southwest than it was known hitherto.

The pottery of the pithouse village was predominantly of Mogollon cultural extraction but also bore the imprint of the influence exerted by the wholly different ceramics of the Anasazi to the north. Sufficient data were gathered from the pithouse village to make a definite appraisal of the imperishable cultural elements involved.

The preliminary excavations in the 12th century pueblo and in the earlier remains in its environs demonstrate the continuity of occupation in the area and the potential resources for working out the cultural history of the Forestdale Valley over a long period of years.

HAURY, EMIL W., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 232–233.

HUGH O'NEILL HENCKEN, Peabody Museum, Harvard University

Grant No. 351 (1939). Preparation of illustrations for report of Harvard Archaeological Expedition in Ireland (1932–36).

This grant has been applied to preparing illustrations for three of the papers dealing with the work of the Harvard Archaeological Expedition in Ireland. The first, by Dr. H. L. Movius, Assistant Director of the Expedition, deals with a site at Strangford Lough, Co. Down.[1] This produced Stone Age material of the Early Larnian culture (Early Mesolithic). This was found *in situ* in Litorina gravels laid down during early stages of the Litorina transgression. A second culture, attributed to the Neolithic, was found in surface deposits overlying both the Litorina (raised beach) gravels and an extensive midden mainly composed of oyster shells. The midden probably belongs to Mesolithic times, and, although no implements were found in it, it is the only occupation site of the Mesolithic Period hitherto discovered in Ireland. This paper was published in the *Journal of the Royal Society of Antiquaries of Ireland*, **70** (1940).

The second paper, by the same author, summarizes his conclusions regarding the chronological position of the Irish Stone Age in terms of the Scandinavian sequence. It has been found that in Britain and Ireland the Late Glacial and Early Post-Glacial record is almost identical with that of the Baltic. The evidence on which these conclusions are based is discussed in a book on the Irish Stone Age being published by the Cambridge University Press. This paper will be published in the *Reports* of the Institute of Archaeology of London University.[2]

The third paper, by Dr. H. O'N. Hencken, Director of the Ex-

[1] The funds for this were spent in December, 1939, but the work has not previously been reported.

[2] We have recently had word that this paper is in the press.

pedition, discusses a site excavated by him at Ballinderry in central Ireland. There were two strata. The lower one was the first Late Bronze occupation site found in Ireland and represented the culture of early Celtic invaders from Britain. The upper one, which belonged to the Christian period (8th century, A.D.), revealed a culture composed of prehistoric and sub-Roman elements. This report will be published by the Royal Irish Academy in 1941.

MOVIUS, H. L., 1940. Report on a Stone Age Excavation at Rough Island, Strangford Lough, Co. Down. Jour. Roy. Soc. Antiquaries of Ireland LXX.
—— 1941. Rep. Inst. Archaeol. London Univ. (In press.)
HENCKEN, H. O'N., 1941. Ballinderry Crannog No. 2. Roy. Irish Acad. (In press.)

GERHARD HERZBERG, University of Saskatchewan

Grant No. 139 (1937). Investigation of the solar spectrum in the photographic infra-red; various investigations of molecular spectra.

The weather during the winter 1939/40 was particularly unfavorable for the work on the photographic infra-red solar spectrum since there were hardly any clear days with temperatures below $-30°$ C. A number of improvements were made on the heliostat as well as on the other optical arrangement for throwing the light on to the slit of the spectrograph, so that it is hoped that spectrograms reaching further into the infra-red may be obtained this winter (1940/41).

In the preceding report the discovery of the B_2 molecule by means of its spectrum had been briefly announced. In the past year the evidence of the B_2 molecule has been confirmed in every way. The moments of inertia and internuclear distances as well as the vibrational frequencies of the B_2 molecule in its ground state and in the excited electronic state, have been determined. The type of the electronic transition observed is in agreement with the theoretical expectations. From the observed intensity alternation in the B_2^{11} bands the spin of the B^{11} nucleus has been determined to be $I = 5/2$, a value that does not agree with the value predicted by either the Hartree or the α-particle model of the nucleus. Further work on the B_2 spectrum is in progress in order to check the value of the spin of B^{11} and in order to determine the spin and statistics of the B^{10} nucleus.

In a further investigation by Mr. A. E. Douglas and the writer, the spectrum of the BN molecule, briefly reported last year, has been investigated in more detail and the rotational and vibrational constants of the molecule have been determined. The main electronic transition of BN is very similar to that of the isoelectronic C_2 molecule.

Finally, the spectrum of the P_2 molecule has been re-investigated by L. Herzberg, G. G. Milne and the writer. The rotational constants, the moment of inertia and the internuclear distance of the P_2 molecule in the ground state have been determined with greater accuracy than heretofore possible.

HERZBERG, G., 1938–40. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 232; for 1938: 178; for 1939: 234.

—— 1940 (with SUTTON, R. B.). Tail Bands of the Deslandres-d'Azambuja System of the C_2 Molecule. Can. Jour. of Res. *A* 18: 74–82.

—— 1940 (with DOUGLAS, A. E.). Spectroscopic Evidence for the B_2 Molecule. Phys. Rev. 57: 752.

—— 1940 (with HERZBERG, L., and MILNE, G. G.). On the Spectrum of the P_2 Molecule. Can. Jour. of Res. *A* 18: 139–143.

—— 1940 (with DOUGLAS, A. E.). Spectroscopic Evidence of the B_2 Molecule and Determination of its Structure. Can. Jour. of Res. *A* 18: 165–174.

—— 1940 (with DOUGLAS, A. E.). Band Spectrum of the BN Molecule. Can. Jour. of Res. *A* 18: 179–185.

FRANK C. HIBBEN, University of New Mexico

Grant No. 388 (1939). Excavation of the Sandia Cave, New Mexico.

In the spring and early summer of 1940 excavations on the Sandia Cave, Sandoval County, New Mexico, were continued and brought to completion. Excavation, which had already been in progress three years, was facilitated by the installation of dust removal equipment, and a greater number of laborers made possible by the grant.

The Sandia Cave was found to be especially valuable in a stratigraphic sequence which involved the now famous Folsom complex. This Folsom layer formed the uppermost of two superimposed cave floors. Both of these cave occupations were in turn covered and sealed in with a layer of calcium carbonate in the form of cave travertine. Above the travertine crust were recent deposits of guano and some indications of Pueblo occupation.

The lowermost cave floor, below the Folsom is separated from the latter by a sterile layer of yellow ochre. The lower level has been named "Sandia" to distinguish it from the Folsom level above. The Sandia occupation is distinct from and earlier than the Folsom with a distinct type of projectile point. This point is side notched in outline and closely resembles some late Solutrean forms of Europe although not necessarily having any connection with them. Two fire areas also occurred in the Sandia level.

Faunal associations show both cave occupations to be Pleistocene or late Pleistocene in date. The Sandia stratum is featured by the remains of Mastodon americanus (Mastodon), Elephas (Mammoth), Camelops (Camel), Equus occidentalis (Horse), and Bison (bison, extinct species).

The Folsom stratum above contains the same faunal assemblage with the exception of the mastodon. There are added in the Folsom, Nothrotherium (giant ground sloth), and Canis (wolf). The ground sloth apparently lingers on into modern times.

With the Sandia Cave deposits a definite sequence of late Pleistocene and early recent cultural events leading up to the complex Folsom culture has been established.

HIBBEN, F. C., 1940. Sandia Cave. Scientific American, July, 1940.
—— 1941. Sandia Cave. (Accepted for publication by the National Museum.)

HUDSON HOAGLAND, Clark University

Grant No. 372 (1939). To investigate the controlling chemical pacemakers (master reactions) involved in respiration of different brain centers.

Succinic dehydrogenase and cytochrome-cytochrome oxidase are amply present in brain cortex according to the literature, and nearly all cortical respiration proceeds through these steps. In extracts (from beef heart) containing these two components and with succinate as substrate, Dr. Hadidian and the writer previously obtained a μ value of 11,200 calories when the dehydrogenase step was made the slow limiting factor, and 16,000 calories when the oxidase was the slow step. These two values had been found by the writer in connection with human brain wave alpha frequencies with advancing brain syphilis.

It seemed desirable to test further μ values *in vitro* with respect to enzyme specificity and thus obtain a better understanding of the

significance of μ before continuing our neurological investigations. The following results were obtained.

The oxidation of p-phenylenediamene catalysed by the oxidase component of the extract mentioned above and known not to involve the dehydrogenase at all yields a μ value of 9,500 calories and not 16,000 calories. A μ value of 17,500 calories is obtained for the oxidation of succinate in the presence of extract partially inhibited by pyrophosphate. Evidence is presented that this value corresponds to a pacemaker other than that of succinic dehydrogenase or cytochrome-c-cytochrome oxidase.

Addition of a suitable amount of cresyl blue to the enzyme reaction mixture, completely inhibited by cyanide, restores the succinate oxidation to normal in pure O_2. In this system in which the dye is substituted for the inhibited oxidase, when the enzyme extract (dehydrogenase) is made the slow limiting factor, a μ of 18,500 calories is obtained; when cresyl blue is made the limiting factor, the μ is 22,300 calories.

Our results indicate that energies of activation are associated not with enzymes as such but with the particular reaction steps involving them as catalysts. The results also confirm the view that the μ value is a definite index of whatever specific reaction is the slow one in catenary series so characteristic of cellular respiration.

HADIDIAN, Z., 1941 (with HOAGLAND, H.). Chemical Pacemakers III. Activation Energies of Some Rate-limiting Components of Respiratory Systems. Jour. Gen. Physiol. 24, 339–352.

DWIGHT L. HOPKINS, Mundelein College

Grants No. 344 (1939) and No. 344a (1939). Studies of the adaptation of amoebae to changing concentration and the regulation of the water content of the protoplasm.

The work up to the present time has been confined to a single fresh water amoeba. This amoeba, it has been discovered previously, can live in fresh water or any concentration of the salts of sea water up to 100 per cent that of sea water. A statistical study has been made of the volume of amoebae grown in various concentrations of the salts of sea water, and the average volume has been found to increase somewhat with the concentration. From a study of the rate of fluid elimination by means of the contractile vacuoles of amoebae living in various concentrations of sea water, it has

been found that (1) the contractile vacuoles form and are expelled in all concentrations in which the amoebae will live and reproduce, and (2) the average rate of elimination per unit of protoplasm varies inversely with the concentration of the medium. The curve with which the average rates most nearly coincide is one in which $xy = c$, where x is the external concentration, y is the rate of elimination, and c is a constant.

Observations have been made of volume changes in the amoebae when the concentration is increased or decreased from that of the culture medium. The observations have shown that (1) the protoplasmic concentration varies directly with that of the medium, and (2) when the amoebae are completely adjusted to the medium, the protoplasmic concentration is only a little higher than that of the medium.

By subjecting vacuoles which remain in the amoebae and others which have been removed from the amoebae to hypotonic and hypertonic solutions, it has been found that (1) the effects are the same on the vacuoles outside as on those inside of the amoeba, and (2) the vacuoles shrink or swell according to the external concentration. It, therefore, can be concluded that the vacuoles contain substances in solution in their fluid contents to which the membrane of the vacuole is not permeable. This substance is eliminated and is therefore a waste product.

Finally, it can be said that the vacuoles have little or no effect on the water content of the protoplasm, but do prevent the accumulation of wastes.

ALFRED E. HUDSON, University of Washington

Grant No. 402 (1940). Study of historical sources and museum collections necessary to supplement and complete an ethnographic field study of the Hazara Mongols of Afghanistan.

This work was carried on in the Yale University Library during the spring of 1940, with the assistance of Elizabeth Bacon.

It was found that the Mongols now known as Hazaras did not settle in Afghanistan at one time, as was generally supposed, but that they came in groups of a few thousand (Hazara, meaning thousand, was a Mongol military unit), chiefly as military garrisons, between 1221 and 1396. The first Mongol garrisons were established in Afghanistan by Ghengiz Khan; later ones by his sons,

and by various succeeding rulers of the western Mongol Empire. The last formal settlement of which we have a record was made by Timur in 1396. It appears that these garrison groups were later augmented by bands of roving Mongol soldiers who were driven out of Georgia and Syria after the fall of the Western Mongol Empire.

The Hazaras apparently acquired their Persian speech and Shiia Mohammedan religion, to some extent at least, during the general iranization of Mongols in Persia during the end of the 13th and beginning of the 14th centuries. This change in language and religion was presumably accelerated by the fact that they were surrounded by Iranian people (ancestors of the present Tajiks). We also find references to Shiia missionary work which was definitely known to influence some Hazara groups.

There is one group of Mongols, however, living to the northwest of the Hazarajat, who still spoke a Mongol dialect in 1906 and who, like their Turkic neighbors the Uzbegs and Turcomans, are Sunni Mohammedans. Like their Turkic neighbors, these western Hazaras are pastoral nomads, whereas the main body of the Hazaras are sedentary agriculturalists.

The original Mongol garrisons were established in the plains and foot-hills peripheral to the Hindu Kush mountain mass. As later non-Mongols invaded Afghanistan, the Hazaras were gradually pushed farther and farther into the mountains, a process which still continues.

In addition to this purely historical investigation, a study was made of Shiia law, and of old Mongol custom, so that individual traits of Hazara culture might be analyzed and traced to their origin. Available material on Afghan tribal customs was examined in order to determine to what extent the Hazaras had been influenced by their more recent neighbors and overlords, the Afghans.

A selected vocabulary was made from the Babur-nama and other early Turco-Mongol writings for comparison with the modern Hazara vocabulary which was gathered in the field.

In addition, a general bibliography was made pertaining to the ethnography of all groups living in Afghanistan, and to Mongol history in other parts of western Asia.

A preliminary report covering certain phases of the work is now in press and a complete report is in preparation.

HUDSON, ALFRED E., 1941 (with BACON, ELIZABETH). Social Control and the Individual in Eastern Hazara Culture: Sapir Memorial Volume (Leslie Spier, editor). (In press.)

ARTHUR L. HUGHES, Washington University, St. Louis

Grant No. 237 (1938). (*a*) Study of the distribution of velocities among atomic electrons. (*b*) Conductivity, and in particular, the photoconductivity of insulating liquids and solids.

The researches on electron scattering call for an electron gun which will give an electron beam of high intensity with but little divergence between electron paths in the beam. An electron gun, using magnetic focusing, has been constructed which will give a beam (*a*) less than two millimeters in diameter, (*b*) carrying over a milliampere of current, and (*c*) diverging less than three degrees. This is considerably better than what was available before. This electron gun is being used in experiments on electron scattering in certain paraffins to obtain information as to the momenta of the electrons in the various types of bonds.

In the research on the conductivity of highly insulating liquids, a liquid has been found (iso-octane) which after suitable treatment with sodium has the highest insulating power yet recorded for any liquid. This liquid is being investigated further. The extremely low natural conductivity will allow us to get results more easily when we induce artificial conductivity by means of ionizing agents such as x-rays and radium.

RONALD L. IVES, Science Service

Grant No. 395 (1940). Continuation of field studies in eastern Middle Park, Colorado.

Field work in eastern Middle Park, Colorado, already assisted by grants No. 242 and 284 (1938), were continued during the field season of 1940, work being stopped October 2 because of snow and low temperatures.

Glacial evidence indicates the following sequence of ice advances during the later Pleistocene:

Name	Moraines	Correlations	Years pre-1900
Neva	Compound	"Little Ice Age"	4,000
Monarch C	Single	Fennoscandian	10,400
Monarch B	Compound	Scanian	13,400
Monarch A	Fragmentary, relations and dating uncertain.		
Arapaho B	Single	Pomeranian Mankato	25,000
Arapaho A	Compound	Brandenburg Tazewell-Cary	35,000
River	Single	Warthe Iowan	65,000
Stillwater	Compound	Riss Illinoisan	125,000 (?)
Walden Hollow, Hell Inlet	Fragmentary, relations uncertain, and age, other than much older than Stillwater, not indicated by local evidence. Datings here used are based on studies by Matthes, Antevs, and Bryan and Ray, with some slight modifications. Additional independent studies in the Estes Park area, by Dr. L. O. Quam, of the University of Colorado, indicate that the same sequence is present there.		

Reconnaissances on the west side of the Never-Summer Range show that the same general sequence of glaciations took place there, and that west-draining valleys in that range supported longer glaciers than those draining east, a condition identical to that in the Front Range.

Studies of solifluction resulted in the discovery of several previously unreported rock glaciers, and disclosed much evidence of soil motion not only in the alpine tundra zone, but in the forested areas some distance below timberline. Many relations between plant distribution, soil stability, and underlying geology were noted.

Diatom collections, started in 1938, were continued, so that, at the close of the 1940 field season, every tributary to the Colorado

River north of the 40th parallel and east of the 106th meridian had been sampled at least once every mile. Samples of water from Middle Boulder Creek, from the Continental Divide to Boulder, were also collected, to supply a linkage between the Colorado headwaters area and the Plains. These water samples are at present being studied by Dr. Ruth Patrick, of the Philadelphia Academy of Natural Sciences, who will report her findings on completion of laboratory work.

Publications resulting from this work since January 1, 1940, are listed below.

Ives, R. L., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 245–246.
—— 1940. Mountain Glaciers of Long Ago. Trail and Timberline, No. 258: 87–92.
—— 1940. Rock Glaciers in the Colorado Front Range. Bull. Geol. Soc. Amer. 51: 1271–1294.
—— 1940. The Origin of Some Polished Stone Artifacts. Amer. Antiquity, 6: 70–72.
—— 1941. Front Range Crest Clouds and Related Phenomena. Geog. Rev. 31: 23–45.
—— 1941. The Green Ridge Pegmatite, Grand County, Colorado. Rocks and Minerals, 16: 12–17.
—— 1941. Detection of Supercooled Fog Droplets. Jour. Aeronautical Sciences, 8: 120–122.
—— 1941. Rapid Identification of the Montane-Subalpine Zone Boundary. Bull. Torrey Bot. Club. (In press.)
—— 1941. The Importance of Solifluction in Producing Postglacial Change (Abstract). Proc. Colo.-Wyo. Acad. Sci. (In press.)
—— 1941. A Cultural Hiatus in the Rocky Mountain Region. Southwestern Lore. (In press.)
—— 1941. Vegetative Indicators of Solifluction. Jour. Geomorphology. (In press.)

Roy W. Jones, Central State College, Oklahoma

Grant No. 334 (1939). The determination of the effect of growth promoting substances on the early differentiation of fish embryos as expressed by the rates of cell division in such embryos.

The procedure used in these studies is to culture the eggs of the Japanese minnow, Medaka, Oryzias latipes, in different concentrations of the chemicals being tested. The egg clutch from a single female is divided into two finger bowls. In one is placed the dilute chemical solution and in the other the corresponding amount

of distilled water. At representative stages in the embryonic development both series of embryos are fixed, embedded and sectioned. For each concentration of chemical used ten embryonic stages are obtained. After sectioning and staining, the cells in the developing eyes of the embryos are counted and the mitotic index calculated. In this way, the effect of the chemical on cell division may be determined and correlated with its effect on morphogenesis and physiology.

Embryos have been cultured in auxilin, thiamin chloride, and colchicine. All have been found to be toxic in very dilute amounts and to affect cell division. Comparisons of the mitotic indices are not available as yet.

Auxilin was found to retard cell division and to inhibit morphogenesis. The formation of red corpuscles was prevented and those formed were destroyed. No embryos that were treated with auxilin hatched successfully.

Embryos treated with colchicine in dilutions greater than 4 parts per million show no visible external effect. In concentrations of 4 to 8 parts per million the embryos are larger than the controls; when allowed to develop completely they hatch sooner and are more vigorous. Concentrations of .001 per cent or greater are toxic.

Thiamin chloride solution of 0.02 per cent concentration is quite toxic. Eggs cultured in 0.0002 per cent solution survive but show cytological effects.

Studies of smear techniques whereby the cytological effects of these drugs can be more quickly determined are being made. It is hoped that a method of study applicable to animal tissue similar to that for plant tissue developed by Eigstei may be obtained.

Rhythmical movements in the periblastic areas around the yolk and in the embryonic shield of the early gastrula were observed. These correspond to similar observations made by Dr. Yamamoto on the same fish. It is suggested that these movements are closely correlated with the concentrations and distribution of cells in the formation of the body axis and are due to surface tension phenomena within the yolk proper.

JONES, ROY W., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 249–250.

—— 1939. Observations on the Effects of Auxilin on the Development and Anatomy of Fish Embryos. Proc. Oklahoma Acad. of Sci. 20: 35–36.

FRANK R. KILLE, Swarthmore College

Grant No. 396 (1940). A study of the seasonal cycle of the gonad in the sea-cucumber (Holothuria parvula) and the bearing of these data on the questions of gonad regeneration within self-sterilized posterior halves.

The dissection of 100 specimens of H. parvula collected at random from the Tortugas during the first week of August revealed the same extreme variation in the development of the gonads as was found in specimens collected the preceding month. A comparative survey of museum material showed that this variation is much greater than that which has been known for certain other species in which the size of the gonad bears no absolute relation to the size of the animal. Microscopic examination of the extremely primitive gonads possessed by a few large specimens of H. parvula revealed nests of germ cells in the mesentery but no gonad tubules. There is reason to doubt that such extreme variation is brought about by a periodic retrogression of the gonad. In this species, posterior halves entirely lacking a gonad frequently result from transverse fission. Since these halves regenerate a new anterior end, the possibility exists that these primitive gonads are stages in the regeneration of the reproductive system which may appear long after all other systems have been reconstituted.

Neither regeneration nor such extreme seasonal retrogression have been demonstrated for the echinoderm gonad. In order to obtain additional data on these questions, arrangements have been made to secure a mid-winter collection of H. parvula from the Tortugas and Bermuda. The dissection of these specimens will be followed by histological preparations of the significant stages for a comparison with those found in mid-summer.

MARTIN KILPATRICK, University of Pennsylvania

Grant No. 335 (1939). Relative acid strength in aqueous and non-aqueous solutions.

The effect of ionic strength on the constants for the equilibrium between certain indicator acids and the anions of monosubstituted benzoic acids has been determined at ionic strengths < 0.02. The results can be expressed by an equation of the general form

$$\log K_{A_1B} = \log [K_{A_1B}]^0 + A(Z_{A_1} - Z_A) - B\mu$$

where K_{AiB} represents the equilibrium constant, Z_{Ai} and Z_A represents the charge of the indicator acid and the substituted benzoic acid respectively and μ is the ionic strength. The constant A at 25° C has the value 1.020 for light water, 1.026 for heavy water, 4.02 for methyl alcohol and 5.94 for ethyl alcohol as solvent. B is the same for light and heavy water. The approximate values of B are 3 for water, 11 for methyl alcohol and 22 for ethyl alcohol for the various acids studied.

The acid strengths relative to benzoic acid have been computed from the colorimetric and electrometric measurements and compared with the values calculated on the basis of the Kirkwood-Westheimer model. The agreement between the observed and calculated values is poorer in the solvents methyl and ethyl alcohol than in water. In other words the observed effect with decreasing dielectric constant of the medium is greater than the effect calculated in terms of electrostatic theory. The calculations are being modified to fit the case of the benzoic acids more closely. The molecules are described as oblate spheroidal cavities of low dielectric constant in a medium of high dielectric constant containing charges on the focal ring.

KILPATRICK, MARTIN, 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 251–252.

—— 1940 (with MEARS, W. H.). Acid-Base Equilibria in Methyl Alcohol. Jour. Am. Chem. Soc. 62: 3047–3051.

—— 1940 (with MEARS, W. H.). Acid-Base Equilibria in Ethyl Alcohol. Jour. Am. Chem. Soc. 62: 3051–3054.

—— 1941 (with ELLIOTT, J. H.). The Effect of Substituents on the Acid Strength of Benzoic Acid I. (Accepted for publication, Jour. Phys. Chem.)

—— 1941 (with ELLIOTT, J. H.). The Effect of Substituents on the Acid Strength of Benzoic Acid II. (Accepted for publication, Jour. Phys. Chem.)

SERGE A. KORFF, Bartol Research Foundation of The Franklin Institute

Grant No. 363 (1939). Investigation of the disruption of the nuclei in the upper atmosphere by cosmic radiation.

With the aid of a grant from the American Philosophical Society, a radioactive neutron source was purchased. This consisted of a radium-beryllium mixture in a small copper bulb. The amount

of radium was 9.87 mg. as certified by the company. This source has been carefully standardized by comparison with other known sources.

The source is being continuously used in testing and standardizing neutron detecting equipment. The particular problem for which this source is now in use is that of studying the neutrons produced by the cosmic radiation. Two separate experimental programs have been partially completed in this connection. These are, respectively, the variation of the neutron intensity with elevation, and the association of the neutrons with cosmic-ray showers.

It will be recalled that neutrons are a numerically important constituent of the cosmic radiation. The mechanism by which the neutrons are produced is not at the present time well understood. Something may be learned about this process, however, by investigating the connection between the neutrons and other cosmic ray phenomena.

The variation of the neutron intensity with elevation was studied by the radio-balloon technique, in which the counting rate of a neutron counter, carried into the stratosphere by free balloons, is transmitted to the ground station by automatic short-wave radio. In this manner it was found that the neutron intensity increased faster with elevation than did the total cosmic ray intensity, especially at the lower elevations. The rate of increase with elevation was found to be the same as that of the large cosmic-ray showers or "bursts." These showers are manifestations of the "cascade" mechanism, and contain many high energy photons. The neutrons are comparatively local in character, and do not travel far from their place of origin. Hence the rate of increase with altitude is suggestive of a possible connection. The most probable mechanism of such a connection would be that the high energy photons would produce disintegrations of the nuclei of the atoms of air in the atmosphere, and that the neutrons would then be the products of disintegration. The observed altitude dependence supports this view.

On the basis of this hypothesis, we should expect to find neutrons produced in the same events as the large showers. An experiment was designed to test this. A neutron counter and a shower detecting unit were so connected that only simultaneous discharges would be recorded. Such coincident discharges were observed at two elevations. The rate observed at the Mt. Wash-

ington Observatory, Mt. Washington, New Hampshire, was about five times the number found at sea level. The fact that a simultaneous discharge occurs at a rate far greater than the "accidentals," as well as the rate of increase of these coincidences with elevation, may be taken as further evidence for this process of photodisintegration of nuclei.

Korff, S. A. The Production of Neutrons by the Cosmic Radiation. (Paper presented November 22, 1940, American Philosophical Society; report in preparation for submission for publication by the Society.)

—— (with Whitaker, M. D., Bright, W. C., Murphy, M. P., and Clarke, E. T.). Comparative Efficiencies of Radioactive Neutron Sources. (In preparation for publication in the Journal of the Franklin Institute.)

Irvin M. Korr, New York University College of Medicine

Grant No. 354 (1939). The relation between metabolism and physiological activity.

By means of manometric and other techniques metabolic changes following hormonal activation of several types of tissue have been studied. These have included salivary glands (submaxillary and parotid), activated by acetylcholine, the pancreas activated by secretin, the uterus (myometrium) stimulated to contract with pituitrin (oxytocin) and the kidney activated by the antidiuretic principle of the posterior pituitary. These have been obtained largely from the cat. Preliminary experiments have also been conducted on the melanophores in the skin of the frog, in which contraction was induced by intermedin and expansion by adrenalin.

With the salivary glands and with pancreas it is found that the large increases in metabolism which normally accompany humoral stimulation are quantitatively eliminated by sodium azide. The resting respiration, however, is not retarded by this inhibitor. In the presence of azide, therefore, no increase in metabolism occurs upon addition of the activating hormone. If the azide is added after activation, respiration is reduced to the resting level. Cyanide also inhibits the increase in respiration accompanying activity, but differs in action from azide in that it causes also a partial suppression of the resting respiration.

Myometrium represents a variation of this situation in that the "resting" metabolism shows a variable azide-sensitive fraction which can be related, at least qualitatively, to the initial tone of the

muscle. In uteri the initial tone of which was experimentally varied by previous treatment of the cat or rabbit with progestin or with estradiol, it was found that the more flaccid the myometrium the lower is the respiration and the smaller is the azide-sensitive fraction; the greater the tone, the higher are these values. Contraction induced by the oxytocic principle is always accompanied by an increase in respiration which is equal to the increase in the azide-sensitive portion. In all cases azide reduces respiration to the level which presumably corresponds to the completely relaxed myometrium.

The conclusion indicated by these experiments is that in these tissues resting respiration proceeds through non-ferrous hydrogen-transfer mechanisms. Upon activation respiration is not only augmented but qualitatively modified in that now a large portion of the respiration proceeds through the cytochrome-cytochrome oxidase system (Warburg-Keilin system). (This change is similar in many respects to that which occurs in fertilization of the sea urchin egg.)

Confirmation of the effects of azide and of activation on the Warburg-Keilin system has been obtained by spectroscopic observation of the cytochrome bands in the submaxillary gland.

Our recent experiments on this gland with a variety of other agents have indicated, further, that the Warburg-Keilin system is non-functional in resting cells not because any of its components are in an inactive form, but because it is not "geared" to other oxidative mechanisms. Data thus far indicate that this gearing is effected, upon stimulation of the gland, by the appearance of a product (or products) of glycogenolysis which in connection with dehydrogenases is capable of reducing cytochrome, directly or indirectly. The writer is now engaged in a study on the submaxillary gland designed to identify this gearing mechanism and to describe other changes in metabolism attending physiological activity (secretion).

Increases in oxygen uptake by whole kidney slices upon the addition of the antidiuretic principle of the hypophysis have been too small for the accurate evaluation of the relative azide sensitivities of the "resting" and "activated" tissue. The smallness of this increase is attributable to the fact that only a very limited and specialized portion of the kidney is capable of physiological response to the pituitary hormone. Experiments are now in prog-

ress to map out the responsive areas of kidney slices with the end in view of identifying that portion of the renal tubule whose water-reabsorbing activities are controlled by the antidiuretic hormone.

RICHARD KRAUTHEIMER, Vassar College

Grant No. 307 (1939). A corpus of the early Christian basilicas in Rome, covering the period from 300–850 A.D., including a complete architectural analysis of the buildings.

The four months from January through April 1940, over which the grant of the Penrose Fund of the American Philosophical Society still extended, were used to complete the drawings of several churches for the second volume of the Corpus of the Early Christian basilicas in Rome. Simultaneously our notes, taken on the spot, were worked up systematically. The churches thus completed are:

S. Prisca. The drawings of the church and of large pre-Christian remnants underneath were terminated. These remnants which had first been uncovered by Séroux d' Agincourt in the late XVIII century proved to have formed part of a large thermal edifice. One room of these thermae had been transformed in the III century into a mystery oratory, dedicated not as had been supposed to Mithras, but evidently to Atys. The original Early Christian church which was erected above these structures turned out to be a basilica, of thirteen arches per arcade, which covered not only the area of the present XVI century church but of the plaza in front of this church as well; its apse is as late as the XII and XV centuries.

S. Lorenzo fuori le mura. A number of IV century walls discovered while investigating the church, were incorporated into the final drawings. The discovery of these walls gave additional proof for the fact that the present VI century east part of the basilica contains remnants of a church of the late IV century which had existed on the same site.

S. Maria Maggiore. The final drawings for this basilica contain the observations made during 1938. At that time special permission had been obtained to investigate the foundation walls of the whole church, which were accessible through the tombs in the pavement of the edifice. The foundation walls uncovered were those under the terminating wall of the left aisle, those under the

colonnades between nave and aisles and those under the long wall of the right aisle, the latter two being investigated at several points. All these walls consist of opus mixtum, the same masonry which according to the Rev. Schuchert's report (A. Schuchert, S. Maria Maggiore zu Rom, I, Città del Vaticano, 1939) was found by him in the foundation wall of the original apse immediately beyond the triumphal arch. This proves that the foundation walls of the entire Early Christian V century edifice were laid out simultaneously. The brick masonry of the upper walls of the church, including both clerestoreys, shows them to have been likewise part of the V century building. Only the transept, the apse, and—as can now be proved—the upper parts of the facade, are later additions.

KRAUTHEIMER, RICHARD, 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 254–255.

GEORGE L. KREEZER, Cornell University and Letchworth Village

Grant No. 379 (1939). The electro-encephalogram (E.E.G.) as an index of cerebral conditions associated with mental deficiency of different levels and types.

The chief problem of this study, the determination of the dependence of the electro-encephalogram on intelligence level, is being investigated by two methods. In the first (cross-section method), the control of the independent variable, intelligence level, is provided by selection of individuals of different mental age levels, with other relevant factors, such as life age, clinical type and sex, in effect kept constant. The work of the year was devoted to extending the size of the experimental population sufficiently to permit more reliable conclusions than were possible in the exploratory studies. With the technical assistance of Mr. Franklin W. Smith, a total of about 600 records were taken of about 300 subjects located at Letchworth Village, Wassaic State School and Rome State School, New York institutions for the feeble-minded.

The second method used (longitudinal method) provides control of intelligence through selection of chronologically young subjects of different *rates* of mental growth, the electro-encephalogram and parallel mental age determinations being obtained at successive life-ages for any given subject. Records were taken at about six month intervals on a group of about thirty-five subjects. Data on four

successive points on the developmental curve are now available for most of the subjects.

The records obtained during the year are still in the process of being analyzed, and should, when completed, permit a fairly decisive test of the conclusions derived from the previous exploratory studies. These studies indicated a significant correlation between intelligence level and certain properties of the electro-encephalogram, the property correlated differing in different types of mental deficiency. It is expected that these results, if confirmed, will provide a basis for identification or investigation of certain of the cerebral factors associated with deviations of intelligence among the feeble-minded.

Kreezer, George L., 1939. Intelligence Level and Occipital Alpha Rhythm in the Mongolian Type of Mental Deficiency. Amer. Jour. Psychol. 52: 503–532.

—— 1939. Research in Progress upon the Electro-encephalogram in Mental Deficiency. Proc. Amer. Assoc. on Mental Deficiency 44: 120–124.

—— 1940. The Relation of Intelligence Level and the Electro-encephalogram. Intelligence: Its Nature and Nurture. Thirty-Ninth Yearbook of National Soc. for Study of Education. Part 1: 130–133.

Margaret Lantis, University of California

Grant No. 313 (1939). Ethnographic study, through the complete seasonal round of the year, of the Eskimos of Nunivak Island, Alaska.

On Nunivak Island, the year's economic activities begin with a highly ritualized spring season of hunting for seals and walrus, for which new kayaks and hunting gear have been prepared in late winter; then they proceed through caribou hunting, cod and halibut fishing in summer to trout and salmon fishing. In early autumn, there is hunting of the migratory birds and gathering of greens and berries for winter; in early winter, the catching of seals in large nets and spearing of fish through the ice, and finally (today) the regulated trapping season. Everything culminates in a long and elaborate hunting festival given in December, for which new songs are composed and new wooden dishes, clothing, drums, other gear are made and displayed, and at which all of the preceding year's tabus are terminated.

In addition to the week-by-week record of such activities, a description of many techniques was obtained: wood and ivory carving and etching, the manufacture of baskets and mats, nets and traps,

skin clothing, boats, houses, and hunting gear. Also recorded were the ritual and tabu connected with all big events in life: birth, first seal-hunt, marriage, death, and other life crises. Family and community relationships, religion, folktales, games and the other recreational and intellectual aspects of Nunivak life complete the picture of the full life of an Eskimo group who have retained a surprising quantity of their old culture.

In summary, Nunivak was found to have a rich economy based much more on plants (particularly grass) and on fish than is the case among Eskimos of the far Arctic. They differ also in having no whale-hunting as well as in many other cultural details. But with all this, they have remained definitely a maritime people: seal-hunting from kayaks dominates all other activities, and the seal catch is the principal basis of wealth. In social organization, particularly kinship relations, Nunivak culture shows a high development and elaboration which may exist elsewhere but has not previously been recorded among these or other Eskimos.

FRIEDRICH W. LENZ, Yale University

Grant No. 438 (1940). Completion of the edition of the discourses of Aelius Aristeides, the second century sophist, and of the scholia or ancient commentary upon them.

After the American Philosophical Society was kind enough to provide the above grant I undertook a series of new studies and carried on some earlier ones, all of which deal with the Greek orator and sophist Aristeides. The ultimate aim of these studies is the completion of the edition of the discourses of Aristeides and the editing of the important scholia. Only the second volume of this edition was published by the late Professor Bruno Keil in 1898. It contains thirty-seven of the discourses. The grant enabled me to go on in the following directions:

1. I succeeded in proving definitely that two declamations, which were found by J. Morelli and Angelo Mai in 1785 and 1825 and attributed to Aristeides, were neither written by Aristeides nor belong in fact to antiquity, but to the Byzantine era. I was able to show that both of them belong to the 14th century writer and scholar Thomas Magister. He was thoroughly acquainted with Aristeides and imitates him excessively, without however being able to conceal completely that his Greek belongs to the language

of the 14th century A.D. It is very characteristic that especially those expressions that are peculiar to the Byzantine language were expelled from the text by false conjectures of modern scholars. This paper is ready for print and negotiations are under way for its separate publication.[1]

2. Because of my proof mentioned above that the declamations mentioned above do not belong to the *Corpus Aristideum* it appears that they should be published again in a separate edition. With the help of new collations I have prepared this new edition and drafted the manuscript. The examination of the decisive Vatican manuscript (*Vaticanus graecus* 714) has enabled me to deal with three other declamations of Thomas Magister which are unpublished up to the present time. It will be necessary, however, to lay a better foundation for the edition of these three declamations by the examination of two other Vatican manuscripts, to which my attention was called by Giovanni Cardinal Mercati, the present Prefect of the Vatican Library. For this purpose I need additional photostats and shall require additional funds for obtaining them. The manuscript of this edition is ready as far as the two pseudo-Aristidean declamations are concerned.

3. I laid the foundation for the edition of the ancient scholia on Aristeides in a book which was published in 1934. Following the rules given in that book, I have drafted the manuscript first of the scholia on the *Panathenaikos*, the most important of all. I have used the material which I collected between 1926 and 1934 in several European libraries and with the help of photostats. My manuscript consists of four handwritten volumes, each of which contains about 200 pages. The edition of these scholia, which are very important for Greek literature and history, will have the value of an *editio princeps*.

The second section which will contain the scholia on the three Platonic discourses of Aristeides is to be taken up next when I have been able to get the necessary funds. The preparatory material has been collected during the last decade.

The third section, which will contain the scholia on Aristeides' declamations and will be much smaller, will follow later. This material also has already been collected.

4. During the past month I have sketched the manuscript of the new edition of the so called *Prolegomena* to Aristeides. The title

[1] To be published in *The American Journal of Philology*.

Prolegomena means the remains of ancient introductions to the writings of Aristeides. We must distinguish between these *Prolegomena* and the scholia, which deal with the interpretation of single passages of the author. The edition of the *Prolegomena* is to be combined with the discussion of several problems, such as the aim, character, and composition of these treatises, which contain also biographical details relating to Aristeides. The relation between the *Prolegomena* and the scholia will be a matter for discussion as well as the question of the authorship of these *Prolegomena*. The actual state of the transmission of these texts in the manuscripts is entirely unknown up to the present time. During the preparatory stage of my research I made many new collations which have enabled me to learn the real transmission of them, and to attempt a reconstruction of the different treatises of the ancient author or authors.

RAPHAEL LEVY, University of Baltimore

Grant No. 327 (1939). Preparation of a commentary on 815 Old French glosses important for French lexicography and mediaeval culture.

A monograph entitled "Recherches lexicographiques sur d'anciens textes français d'origine juive" presented 815 glosses based on manuscripts and printed material found in Europe. The purpose of this grant was to prepare a commentary in order to explain properly the utility of the glosses for French lexicography and for mediaeval culture. Copious notes have been taken from some 1400 vocabularies of Old French texts and of modern French dialects. For each gloss all special references which may yield pertinent material as to its origin, its diffusion, or its application are consulted. The grantee completed 102 of the word-studies during 1940, and he has begun to prepare the others.

LEVY, RAPHAEL, 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 257.

—— 1940. The Plural Usage in Judaeo-French. Mod. Lang. Notes 55: 532–534.

—— 1940. A Proposal for Old French Lexicography. Mod. Lang. Quarterly 1: 333–338.

—— 1940. Apostilles judéo-françaises. (To be published in the Bernhard Heller Jubilee Volume, edited by Alexander Scheiber of Budapest.)

Carl C. Lindegren, University of Southern California

Grant No. 455 (1940). To analyse bacteria genetically with a view to listing the different genes and describing their various effects.[1]

In earlier work we demonstrated non-random crossing-over in Neurospora. Because the conclusions from this study were at variance with the views of many authorities on crossing-over, it was thought necessary to collect more data to determine if sampling errors could have led to our conclusions. These repeated experiments led to identical findings and corroborated certain indications of the earlier work.

This study of crossing-over between four regions on the sex chromosome of Neurospora crassa (I and II on the left of the centromere and III and IV on the right) based on tetrad analysis revealed locally specific patterns of chromatid and chromosome interference as follows:

1. Between regions I–IV and similarly between regions II–III there was a high degree of negative chromatid interference and a high degree of negative chromosome interference. This produced more than the expected amount of crossing-over and an excessive number of 2-strand exchanges. These regions are symmetrically placed across the centromere.

2. Between regions I–II, and similarly between regions I–III there was no evidence of chromatid interference. However, there was a significantly high degree of positive chromosome interference.

3. Between regions II–IV and similarly between regions III–IV there was a high degree of positive chromatid interference and a high degree of positive chromosome interference yielding few double exchanges which were preponderantly of the 4-strand type.

In view of this demonstration of local distribution of specifically different crossover patterns, it is manifestly impossible to draw any conclusions concerning the randomness of crossing-over by indiscriminately combining data collected from different regions along the chromosome.

An excessively high proportion of triple and quadruple exchanges was found. At the same time between certain regions

[1] Permission was obtained to change the objective of the investigation to a comparison of the effects of ultra-violet and X-radiation on mutations in Neurospora; this investigation is now in process.

The calculation in the study of crossing-over in Neurospora has now been completed and the conclusions reached are submitted herewith.

positive chromosome interference was demonstrated. Therefore, a limited amount of positive chromosome interference does not necessarily exclude the possibility of an excessive number of multiple exchanges occurring.

Doctors Huskins and Newcombe have kindly permitted the writer to study a manuscript in press in *Genetics*, in which they draw practically the same conclusions concerning the distribution of chromatid and chromosome interference. They studied a higher plant (Trillium) by cytological technique. This totally different approach is effective corroboration, and the demonstration in a different species indicates a more or less general application of the conclusions.

GUY S. LOWMAN, JR., Linguistic Atlas, Brown University

Grants No. 341 (1939) and No. 444 (1940). The linguistic geography of Pennsylvania; the linguistic geography of the Western Pennsylvania culture areas.

My field work for the proposed linguistic atlas of the Middle Atlantic States has been completed in Western Pennsylvania and in the State of West Virginia. Only those Ohio counties immediately bordering on West Virginia and Pennsylvania have been studied as an aid to the partial delineation of features of the Western Pennsylvania culture areas. New York, New Jersey, and derivative areas of Ontario remain to be done.

There are three principal types of speech in Western Pennsylvania, as evidenced by the distribution of certain key words and pronunciations west of the Alleghanies. In what may be called the Pittsburgh area, including a portion of Washington County and extending north to Conneaut Lake in Crawford County, and northeast to Clearfield County, the vowels in words such as *not* and *law* are identical, a weakly rounded sound. Also a peculiar type of *r* with the tongue-tip curled up close to the post-alveolar surface is found in this region. It lacks the lateral constriction of the tongue and concomitant raising in the palato-velar direction which is characteristic of the usual American *r*. A large scale migration of Scotch-Irish, direct from Europe, came into this region after 1771, continuing on into the nineteenth century.

The Scottish word *hap* for a type of bed cover is found not only in the Pittsburgh area but as far east as the Susquehanna, where

it must be explained on the basis of the early Scotch-Irish migration to Eastern Pennsylvania.

North of the Pittsburgh area the speech is clearly derivative from Western New England, as it is in northernmost Ohio.

In Columbiana and Jefferson counties in Ohio and in the northern panhandle of West Virginia and in the western part of Washington County, Pennsylvania, the vowels of *not* and *law* are treated as two separate vowels as in Chester County, Pennsylvania, and Newcastle County, Delaware.

In Belmont County, Ohio, and in many parts of West Virginia, the vowel in *law* is raised and well rounded as in Philadelphia, Baltimore, and Western Maryland.

Greene County, Pennsylvania, exhibits Virginia traits as well in the pronunciation distinctions in pairs of words such as *horse, hoarse* and *morning, mourning*.

The New England word *teeter*, introduced into the early Marietta, Ohio, settlement has displaced the usual Pennsylvania and Virginia term *seesaw* and has spread down the river to Kentucky on the West Virginia bank as well.

West Virginia south of the New River had many late settlers from North Carolina. Vowels and diphthongs are raised and fronted with much prolongation. Some speakers pronounce *past, fast* and *aunt* to rhyme with *paste, faced, ain't*.

Monroe, Greenbrier, and Pocahontas counties, north of the New River and bordering on Virginia, have short vowels and diphthongs.

In general the distribution of individual items is often rather patchy in West Virginia and Southern Ohio as might be expected in a newly settled region of varied topography.

On December 31, at the seventeenth annual meeting of the Linguistic Society of America in Providence, Rhode Island, a paper was presented by Professor Hans Kurath, entitled "Pennsylvania English," a preliminary presentation of my findings. Based chiefly on vocabulary differences, it appears that there is a major dialect boundary running through Northern Pennsylvania, forming the northern boundary of what may be called the Central type of American English and representing essentially the vast spread of population from Colonial Philadelphia and Newcastle. It will be interesting to attempt to trace this boundary further west through northeastern and central Ohio to northern Indiana and north central Illinois. We can establish the southern boundary of this

Central speech, which is essentially Pennsylvanian in origin, in central Delaware and central Maryland, running along the Blue Ridge in Virginia and turning south to include the western half of North Carolina and the fringe of South Carolina and Georgia; presumably it will include also some of northern Alabama and northern Mississippi. Naturally, individual variations are greater in this Central area than in the remaining regions—the Southern and the Northern.

LOWMAN, GUY S., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 258–259.

WILLEM J. LUYTEN, University of Minnesota

Grant No. 432 (1940). Analysis of the distribution of stellar motions in the southern hemisphere.

This report presents a summary of the work done between July 1 and Dec. 31, 1940. During this period measures were made—by student-assistants—of the motions of more than 5,000 stars between declinations — 50 and — 45; these measures have been reduced, photographic magnitudes and positions in the sky have been determined and these data have been recorded on filing cards. This completes the work on the area south of declination — 45, comprising more than 44,000 stars. Similar measures and reductions have now been begun for the 8,000 stars in the zone between declinations — 45 and — 40.

At the same time the final catalogue of the motions of 28,535 stars (involving 35,000 measures) south of declination — 50 has been typed and made ready for publication with the aid of a WPA grant.

A discussion of the stream- and solar-motions of 92,500 stars which was completed last year will appear in the March 1941 number of the *Astrophysical Journal*.

LUYTEN, WILLEM J., 1941. The Stream Motions of 92656 Stars. Astrophys. Jour. 93: (March).

JOHN FRANCIS MCDERMOTT, Washington University, St. Louis

Grant No. 345 (1939). Biography of Auguste Pierre Chouteau.

In August and September 1940 I spent a month in Washington, D. C. At the Federal Archives I examined in the Office of Indian

Affairs (Department of the Interior) all documents concerning the Osage Indians together with other pertinent Indian material. A search through the War Department Archives there also required much time. Other divisions consulted in the Federal Archives were the State Department records and Maps and Charts. At the Library of Congress, in addition to the regular collections, the manuscript division, the newspaper reference, and the rare book room took much of my time. While in Washington I consulted also the Bureau of Ethnology, the Surveyor-General's Office, the Quartermaster-General's Records at Fort Myer, and a number of minor sources. I have now a considerable body of material about the official activities of Chouteau. A field trip through Arkansas, Oklahoma, Kansas, and visits to Des Moines and Chicago will probably complete my investigations.

McDermott, John F., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 259–260.

Daniel T. MacDougal, Carmel, California

Grant No. 429 (1940). The causes of disjunctive growth activity of roots and shoots, especially trees. (This work was done with the collaboration of J. Dufrenoy.)

Isolated cultures of branching segments of growing terminals of pine roots in symbiosis with soil fungi—mycorrhiza—have been continued under natural conditions to a total extension of twenty-eight months. Primary growth—elongation and differentiation—ending in decortication and formation of cambium followed by death of the basal portion of the roots maintains the approximate length of the segments. Cell-division and mitoses in the root-tips are of a normal pattern. Chromosomes are twenty-four in number.

The single fruit of the cooperating fungus found was that of Elaphomyces. The septate hyphae form a thick mantle about several centimeters of the root. Branch hyphae form a network among the cells and following the middle lamella of joint walls of the cortical cells but do not penetrate or come into direct contact with the protoplasts. Externally hyphae extend and branch luxuriantly, connecting with flaky mycelial masses constituting an absorbing system with a capacity many thousands of times that of any root-hair system.

The principal problems as to the scheme of nutrition of these autonomous mycorrhizae are those which concern nitrogen assimilation, absorption and elaboration of carbon compounds, derivation of vitamines, growth-promoting substances and respiratory ferments. Some positive and much suggestive evidence as to phases of all of these has been found.

The mycorrhizal fungus is rich in amino-acids, peptides or proteins, since heating sections of mycorrhiza in a solution of ninhydrin stain the hyphae a beautiful purple around the cortical cells. In the root-tissue only some phloem elements stain. The nitrogen compounds in humus are largely heterocyclic, such as derivatives of pyridine, and decompose very slowly, but may be broken down by the mycorrhizal fungus with consequent elaboration of nitrogenous material as above.

Carbohydrates adequate for growth for over two years have been synthesized, with accumulation of surplus material: starch grains were observed to be actively formed within amyloplasts, in the cells of the perivascular tissue, nearest to the catechol layer of the endodermis.

In the same way that pyridine might be a source of nitrogen, catechol might be a "source" of carbon, the form through which carbon is being translocated, and also the main "substrate" for respiratory activity. Catechol has been repeatedly quoted in the literature as used by fungi, and recently a fungus, probably identical with the one in the mycorrhiza of the beech, when grown on culture media, was reported to be stimulated when a mixture containing catechol and an oxidase was added.

Our cytological examination shows that primarily exchanges between the fungus and the root take place (1) through the walls of the hyphae which follow and break down the pectic substances of the middle lamella of the cortical cells and (2) through the inner walls of the cortical cells as described in the second paragraph. The final exchange is across a complete cylindrical layer of endodermis, every cell of which has a large vacuole containing a solution of catechol or catechol tannin.

The life cycle of the mycorrhiza from the time of the root tip infestation by the fungus to the time of its abscission, may be linked up with the evolution of the catechol compounds in the endodermis layer. Catechol represents one of the most important respiratory systems in the plant cell. Under the normal conditions of acidity

and oxidation-reduction prevailing in the vacuolar solution, catechol is protected from oxidation by reducing substances such as sulfphydril compounds (operating in cysteine) and ascorbic acid. When, however, these protecting substances are themselves oxidized, they can no longer prevent catechol from being oxidized to quinones. As catechol oxidizes, it undergoes molecular aggregation, and builds up such "gummy" brown masses as fill in the vacuoles of endodermal cells of mycorrhiza; such compounds still display the property of vacuolar solution, as they stain with neutral red when fresh sections are immersed in this dye. Cytochrome-oxidase activity, which is the best measure of the metabolism in the tissue and which is correlated to the functioning of catechol as a respiratory system was found to be most intense where fungus and root are in closest association.

The presence of hetero-auxins (indol-acetic acid) in the fungus and in the cells of the root internal to the mantle, and especially around initials in which cells of the pericycle and endodermis begin to develop as rootlets has been demonstrated. Such excitation and subsequent checking action on elongation would account for the development of the coralloid rootlets.

Of the several accessory substances necessary for growth, the synthesis of Vitamin B_1 has been found so widely distributed among fungi that its presence may be assumed in the mycorrhiza under observation. Two other factors of the Vitamin B complex, pyridoxin (Vitamin B_6) which has been demonstrated by Robbins to be a growth factor for excised roots of tomato, and nicotinic acid, are both pyridine derivatives. Pyridine has been assumed by Waksman to be a significant source of nitrogen for soil organisms, thriving in humus, and may yield nicotinic acid by the introduction of a carboxylic group at the carbon 3 in the cyclic chain.

The fact is well known that one organism, a chlorophylless Chilomonas can convert carbon dioxide, synthesize sugars and form starch in the entire absence of light and that a mould, Aspergillus, shows exaggerated growth in air with a high content of carbon dioxide, makes it pertinent to recall that the air in humus is high in this gas. No attempt has been made to obtain experimental evidence as to similar action by the mycorrhiza of the pine.

It is planned to carry on experiments to detect pyridin and pyridine derivatives in their place in the tissues of mycorrhiza by the use of color reactions and cultures in synthetic media.

In the continuation of the cultures attention will be paid to relative vigor and activity of the root-segments to detect a possible "running down" with the prolongation of independent existence.

Identification of the fungus which associates with the pine roots in mycorrhiza of the pine in its native habitat is to be confirmed.

Synthesis of mycorrhiza by infection of sterile cultures with cooperative fungi, in which some success has already been attained, will be continued for the purpose of evaluating the nature of the exchange between root and fungus.

Effort will be made to determine the part played by the phenolic solutions in the endodermis in the metabolism of the symbiotic partners with especial reference to the synthesis of carbohydrates finally accumulating as starch in the parenchymatous cells of the stele.

It is important to ascertain extent and path of basipetal conduction of carbohydrates and the growth-promoting substances absorbed or produced by the mycorrhiza, and to ascertain if any of this organic material reaches the cambium of the trunk. Since the woody material of the roots has a volume equivalent to 14–25 per cent of that of the trunk and branches, the possibility exists that the construction of a large amount of wood is from carbohydrates synthesized by the mycorrhiza.

REGINALD D. MANWELL, Syracuse University

Grants No. 282 (1938) and No. 413 (1940). Immunity in avian malaria, with special reference to the occurrence of exoerythrocytic schizogony in Plasmodium circumflexum infections.

The fact that the newly discovered pigment-free stages, or exoerythrocytic forms, which have been found to occur in six species of avian malaria (and have also now been reported in three species of human malaria) are not always present suggested that their occurrence might bear some relation to the natural resistance of the host.

The problem has so far been attacked from two angles, and the results indicate that the natural resistance of the host is at least one of the factors determining the occurrence of pigment-free stages. The evidence for this belief is:

(1) In Plasmodium relictum var. matutinum exoerythrocytic schizogony has been demonstrated chiefly in naturally fatal cases.

Birds which have been sacrificed at various stages of the infection have exhibited the pigment-free forms in a much smaller proportion of instances.

(2) The same observation has been made in birds infected with Plasmodium circumflexum. Furthermore it has been noticed that this type of schizogony is seldom seen in birds inoculated with blood from chronic cases (in such blood the number of parasites is relatively small, and there are also certain immune factors), but is much more frequent when the parasite-dosage is heavy, as it is when blood is taken from acute infections. And in these, immune substances have not yet developed to any considerable extent.

(3) Experiments which have been made to discover whether single parasites (or very small numbers) of Plasmodium circumflexum are capable of producing an infection have shown that in a very small proportion of cases such infections can be produced, but that they are very mild, characterized by a long incubation period, and exhibit no pigment-free stages. Infections produced by the injection of blood from these mild cases also showed no pigment-free stages, but after a number of passages (five or six) the infections became more severe and exoerythrocytic forms were again seen. It seems likely that the delay in the appearance of these forms was due to the small numbers of parasites contained in the inocula (due in turn to the very mild infections produced in the first instance), and quite possibly to the existence of immune factors in the blood containing the parasites, due perhaps to the long incubation period in which such substances could develop. The isolation of single parasites was attempted in two ways: (1) by a Chambers micromanipulation apparatus, and (2) by dilution, with calculation from the degree of dilution of the probable number of parasites in the inoculum. In the former case, of eighteen birds so inoculated two infections resulted, and in the latter, twenty-nine birds were inoculated with varying doses of parasites, ranging from 60,000 to a calculated dose of 0.5 parasites. Dosages of 1000 parasites or more gave infections in every instance, but lower dosages were not always successful. Ten birds which received a calculated dose of 1 parasite each yielded five infections, and of four cases injected with a calculated dose of 0.5 parasites one resulted positively.

That there are other factors than efficiency of the defense mechanism of the host which influence the occurrence of the pigment-free

forms is quite certain, however, for it has been found by us and by other workers that there are strains, even in species exhibiting exoerythrocytic schizogony, which seem never to exhibit such stages (though it may be that if rapid passage were attempted and enough cases were observed, such stages would be observed in these strains also), and it has been shown by Wolfson[1] (1940) that a strain of Plasmodium cathemerium which exhibits pigment-free forms more or less regularly in the canary never does so in the duck, or in canaries inoculated directly from the duck. But here too, after a few passages in the canary, these stages are again seen.

It is also possible to draw several other conclusions of some interest from the work which has been done under this grant, especially the following:

(1) The demonstration that exoerythrocytic schizogony occurs in infections produced by the injection of parasites from cases infected (after a number of passages) from single parasites, shows that pigment-free forms may originate from erythrocytic stages as well as from sporozoites. This is a matter which has been in controversy.

(2) It also makes it virtually certain that these pigment-free or exoerythrocytic stages are a part of the malaria life-cycle, and not some other species of parasite (such as Toxoplasma) as claimed by some.

(3) The rather irregular occurrence of these stages suggests that they may not be a necessary part of the life-cycle (except possibly in the initial stages of the infection, when produced by sporozoites) but that they may represent more the biological potentialities of the malaria organisms, indicating their close relationship to such forms as Hemoproteus and Leucocytozoon in which multiplication occurs normally in cells of the reticulo-endothelial system.

(4) It has also been shown that Culex pipiens may serve as a vector of Plasmodium relictum var. matutinum.

In conclusion, it is also evident that much more work needs to be done on this whole problem, and the most important phase of it seems to be the actual relationship which exoerythrocytic forms bear to the sporozoites, and the details of the derivation of the former from the latter. It is quite possible that pigment-free forms observed relatively late in the course of the infection (as, for example, in blood-induced infections of Plasmodium relictum var.

[1] Wolfson, Fruma. Amer. Jour. Hyg. (Section C) 31: 15–28 (1940).

matutinum) may not be exactly the same as those which have been found in other species (and by us also in the species just named) in sporozoite-induced cases; in the latter they occur much earlier.

It is also important to discover whether pigment-free forms occur with equal frequency, or are demonstrably affected, when treatment is attempted with serum from immune cases. That such treatment is effective in aborting or alleviating infection has been shown by Manwell and Goldstein (1940) in avian malaria due to Plasmodium circumflexum.[1]

MANWELL, REGINALD D., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 260–265.

—— 1940 (with GOLDSTEIN, FREDERICK). Passive Immunity in Avian Malaria. Jour. Exp. Med. 71: 409–422.

—— 1940. Life-cycle of Plasmodium Relictum var. Matutinum. Amer. Jour. Tropical Med. 20: 859–865.

—— 1941 (with COULSTON, FREDERICK). Successful Chemotherapy of a Virus Disease of the Canary. Amer. Jour. Vet. Res. 2: 101–107.

—— 1941 (with COULSTON, FREDERICK). Single-parasite Infections and their Relationship to Exoerythrocytic Schizogony in Plasmodium Circumflexum. Amer. Jour. Hyg. (In press.)

LAWRENCE MARTIN, Library of Congress

Grant No. 443 (1940). Completion and verification of a manuscript dealing with Captain Nathaniel Brown Palmer's Antarctic explorations between 1819 and 1831.

Seven exploratory cruises in Antarctic waters were taken by Captain N. B. Palmer of Stonington, Connecticut, between 1819 and 1831. In 1819–20, as second mate of the brig *Hersilia*, he participated in the exploration of the western portion of the South Shetland Islands. In November 1820, as master of the sloop *Hero*, he discovered the Antarctic mainland as well as Port Williams, the crater harbor inside Deception Island, Orleans Channel the fiord between Trinity Island and the Palmer Peninsula of Antarctica, and Yankee Sound, the strait between Friesland and Greenwich Islands. In January 1821 he explored the whole west coast of the Palmer Peninsula between Deception Island and Marguerite Bay in 68° S. Lat. In February of the same year he explored portions of the coast of Elephant Island in the South Shetland archipelago. In November 1821, as master of the sloop *James Monroe*,

[1] During much of this work Frederick Coulston (formerly Goldstein), a graduate student in the author's laboratory, has acted as assistant.

he made further explorations on the west coast of the Palmer Peninsula and revisited Marguerite Bay. In November and December 1821 and January 1822 he discovered, jointly with Captain George Powell, the South Orkney Islands. In February, March, and April, 1830, as master of the brig *Annawan*, he revisited the South Shetland Islands, explored the waters to the west as far as 103° 03′ W. Long. and 58° 01′ S. Lat., and then sailed northeastward to the Island of Mocha on the coast of Chile.

The expense of these seven exploratory cruises was met by the sale of seal skins and seal oil. Sealers of various nationalities took at least 374,823 fur seal skins in the South Shetland Islands between 1819 and 1891, and 159,000 of the pelts were taken by the crews of sixteen American vessels in 1820–21 when the fur seals were nearly exterminated.

During the voyage of 1829–31 the American vessels carried with them five competent scientists including Dr. James Eights of Albany, N. Y., whose technical investigations in geology, botany, and zoology were of high quality. The field studies of Dr. Eights and his colleagues in southeastern Argentina and southern and southwestern Chile, en route to and from the Antarctic, seem to constitute the first scientific investigations on the mainland of South America by learned men from the United States of America.

The American Philosophical Society's grant is making it possible to complete, copy, verify, and professionalise the text of this manuscript and to compile the first drafts of certain of the maps which will illustrate the eventual publication. One such map, showing the routes of Palmer's ships *Annawan* and *Penguin* and ten other exploring vessels in the Pacific waters southwest of Cape Horn between 1774 and 1934, has been supplied in manuscript to the United States Antarctic Service for use in 1941 during the voyages of the *North Star* and the *Bear* to the East Base in the Palmer Peninsula. With the aid of this map it will be possible for these vessels to localise the untraversed waters in which further search may be made for certain islands Captain Palmer attempted to find in 1830.

New data have been revealed by correspondence with individuals and institutions in Uruguay, Argentina, Norway, Germany, and Russia as well as Stonington, New London, and New Haven, Connecticut; Nantucket, Massachusetts, and in the National Archives of the United States.

A day-by-day plotting of the voyage of the sloop *Hero* from Stonington, Connecticut, to the Palmer Peninsula of Antarctica and back again to Connecticut in 1820–21, demonstrates that Captain Palmer sailed his 47-foot sloop some 10,000 nautical miles in 100 days at sea southbound and some 8,137 miles in 82 days northbound. The rates per day ranged from 14 miles to 189 miles. Upon the basis of the average of 100 miles a day thus established during a voyage of 18,137 miles in 1820–21, it is possible to confirm the verity of Captain Palmer's assertions concerning places he visited during short periods for which no logbook entries are at present available. There is no case in which the distance between a place from which his contemporaries saw him set sail, and return, and an objective he is said to have reached is greater than he could have sailed at the average speed resulting from the daily records during the long ocean voyages between Connecticut and Antarctica.

Martin, Lawrence, 1940. Antarctica Discovered by a Connecticut Yankee, Captain Nathaniel Brown Palmer. Geog. Rev. 30: 529–552.

—— 1940. Early Explorers of Southern South America from the United States. Nature 146: 238–239.

Grace Medes, Lankenau Hospital Research Institute

Grant No. 383 (1939). Purification and characterization of enzymes which act on organic sulfur. (The investigation of the sulfur oxidizing enzymes of the liver of the albino rat was made by Grace Medes and Norman F. Floyd.)

An enzyme of the liver of the albino rat oxidizes cysteine to cysteic acid. Its oxidizing effect on related sulfur compounds has been studied to learn something of its mode of action and its degree of specificity. Slices and extracts of liver prepared by a number of methods have been employed. The oxygen taken up and the carbon dioxide eliminated by the various substrates in the presence of the enzyme preparations have been measured in the Warburg respirometer.

The sulfur of homocysteine and of thioglycollic acid, like that of cysteine, is oxidized quantitatively to the $-SO_3H$ stage, pointing to the conclusion that the amino group (not present in thioglycollic acid) is non-essential. Carboxyl, on the other hand, must play some regulatory role, since the oxidation of n-butyl mercaptan and isoamyl mercaptan takes place slowly and no definite end-point could be demonstrated. When the hydrogen of the thiol is replaced

by a methyl group, as in methionine, oxidation is very slow; substitution of an ethyl group, as in S-ethyl cysteine, completely inhibits the reaction. Partial oxidation of the sulfur, as in sulfinic acid and methionine sulfoxide, likewise prevents any further addition of oxygen. No decarboxylation of these substances occurs.

A second enzyme of the liver of the albino rat oxidizes one sulfur of cysteine to the same stage. Simultaneously, *one* carboxyl is removed, as shown by the evolution of CO_2. Previous decarboxylation, as in cysteine amine, completely prevents further action unless the sulfur has been partially oxidized. For example, diamino diethylene dioxide is oxidized to the $-SO_2H$ stage with even greater ease than is cysteine. Diformyl cysteine, in which the amino group is masked, cannot serve as substrate.

We have completed work with the first of these two enzymes and are now preparing a manuscript for publication. We shall probably send it to the *Biochemical Journal* where previous articles of this series have appeared. We are continuing our investigation of the second enzyme.

ELIZABETH L. MOORE, St. Lawrence University

Grant No. 347 (1939). The French settlers in northern New York State.

In 1790 northern New York State was still a great wilderness. Land speculators bought up great tracts of land there and succeeded in selling some of the land to companies in Europe. Among these companies was the Castorland or New York Company which bought 600,000 acres of land much of which was sold in France.

Settlement was begun by representatives of this company in 1793 when Desjardins and Pharoux came from France to survey the land, clear ground, build a sawmill and a grist mill, establish company headquarters and otherwise open the land to settlers. They were joined by a few other refugees during the next few years. The first attempt at settlement was declared a failure and given up in 1798 but considerable progress had been made. The Castorland Journal in the Massachusetts Historical Society Library in Boston is a careful record of this settlement.

The management of the land was next taken over by Rodolphe Tillier, a Swiss, who made a failure of it and finally by Gouverneur Morris under whose management the settlement grew although it did not prosper financially.

Gouverneur Morris acted also as agent for James Donatien Le Ray de Chaumont, one of the original shareholders of the company and a considerable landowner in the section in his own right. Le Ray relied on Morris's management until 1807 when he came over himself to take over the management both of his own lands and of those of Castorland.

Le Ray lived on his lands, building two houses on them and helping to develop the country. Particularly interested in agriculture, he was the founder of the Jefferson County (New York) Agricultural Society and instrumental in the founding of the New York State Agricultural Society. He was, however, overburdened with land which it was necessary to sell off as he owned in the section at one time, 348,206 acres, much of it bought for speculative purposes.

After 1815 a large number of prominent Bonapartists bought land from Le Ray and some of them came to settle near him. Joseph Bonaparte had a summer home there. Réal, Grouchy and many others came to the section.

When life became more settled in France, land sales there were more difficult. The westward migration in the United States took away settlers from northern New York State. Le Ray found himself burdened with great quantities of land. He continued developing his land, spending money and not making enough sales until he was forced to turn over the management of his affairs to his son, Vincent. The latter continued land sales bringing over at intervals groups of settlers from France.

Records of these settlers dealing with their life in northern New York State, their opinions of the United States, their connections with other groups of settlers of the same period, their place in Jefferson and Lewis Counties and their contributions to the life there, were studied.

HANS J. MORGENTHAU, University of Kansas City

Grant No. 467 (1940). The relationship between the political philosophy of liberalism and foreign policy, with special reference to the basic ideas of pre- and post-World War foreign policy.

Foreign policy, like any other creative manifestation of the human mind, is not an isolated phenomenon which can be fully understood through the knowledge of its own elements. Foreign policy

is an integral part of culture as a whole and reflects in its theory and practice the concepts of man and his world, which dominate an epoch. Hence, it is only through the analysis of the general philosophy of a given time that it is possible to understand the foreign policy of this particular time.

This principle is applied to the foreign policy which dominated the two decades following the World War. It becomes evident, then, that the main intellectual elements of this foreign policy are derived from two sources: from the rationalistic philosophy of the seventeenth and eighteenth centuries and from the political philosophy of liberalism. Whereas rationalism has chiefly influenced the theory of foreign affairs—see for instance the utopian projects for the solution of international problems—it was particularly the domestic experience with liberalism and its philosophical manifestations from which the foreign policy of the post-World War period received its guiding ideas, the models for its institutions, and the blueprints for the solution of its problems.

The failure of this foreign policy is mainly due to the misunderstanding of the domestic experience with liberalism, upon which liberal political philosophy is based. The ideas of liberalism were successful in the domestic field under certain historic conditions. By generalizing those ideas and regarding them as universal truths, liberal foreign policy has applied them to the international scene where the conditions are largely absent to which liberalism owes its victories in the domestic field.

Thus, liberal foreign policy has not only met inevitable disaster but has also placed in jeopardy the very survival of liberalism in the domestic field.

CURTIS L. NEWCOMBE, University of Maryland

(Now at College of William and Mary)

Grant No. 356 (1939). A physical, chemical and biological investigation of the layer of low oxygen content in the deeper waters of the Chesapeake Bay.

Studies on the characteristics of low oxygen waters of Chesapeake Bay were continued during 1940. Working toward an explanation of the factors tending to produce abnormally low concentrations of dissolved oxygen in the deeper strata, attention has been

given to a method suitable for measuring the oxygen consumption of subsurface waters *in situ*.

The dropping mercury electrode method was tried for measuring dissolved oxygen under laboratory conditions by Dr. Rodney Olson who early assisted in this study. These laboratory experiments were continued with Mr. Alfred Armstrong at the Virginia Fisheries Laboratory and the Department of Chemistry of the College of William and Mary.

Results of laboratory analyses show that the dropping mercury electrode method under most favorable conditions is satisfactory for measuring dissolved oxygen in water thus confirming the recently published results of Manning in October, 1940 (*Ecology*, 21, no. 4: 509-512). After repeated experiments in which the effect of varying external conditions was related to the precision of measurement and the constancy of the electrical circuit, it is concluded that, until extensive modifications and adaptations are devised, this method of measuring oxygen consumption *in situ* is impractical for use in the deeper waters of the Bay.

In our previous report to the American Philosophical Society, mention was made of evidence that phosphates are liberated in darkness by planktonic organisms resulting in the presence of appreciably higher concentrations in the water at night than during the hours of daylight (Newcombe and Lang, 1939). Continuing these observations on the phosphorus content of the Bay waters, samples were taken at close time intervals and also day and night samples were collected at random with respect to time. The results indicate a characteristic increase during and following the hours of sunset and a corresponding decrease during the morning hours. Although considerable variation was found between the different series taken, nevertheless, there was a general agreement with respect to the occurrence of higher concentrations during the hours of darkness. These findings are supported by random samples taken at the same station throughout the summer season.

Existing information on phosphorus metabolism in the sea does not permit an explanation of the diurnal change. It is not due to the inflow of adjacent water masses. The most plausible hypothesis seems to be that there is an actual phosphate liberation during night time by the living plankton organisms in sufficient quantities to account for the observed fluctuation.

The data show that during summer, the phosphorus and oxygen cycles in the upper stratum of water (about 8–10 meters in thickness) are different from these in the lower levels of relatively high salinity water. It is believed that the heavier, bottom waters originating in the ocean gradually acquire new characteristics when confined in the Bay. Projected studies on the physical and chemical characteristics of waters at the mouth of the Bay aim to follow the changes which the waters of oceanic origin undergo on entering and moving up the Bay.

NEWCOMBE, CURTIS L., 1939–40. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 209–211; for 1939: 267–268.

—— 1938 (with HORNE, WILLIAM A.). Oxygen-poor Waters of the Chesapeake Bay. Science 88: 80–81.

—— 1939 (with LANG, ANDREW G.). The Distribution of Phosphates in Chesapeake Bay. Proc. Amer. Philos. Soc. 81: 393–420.

—— 1940 (with BRUST, HARRY F.). Variations in the Phosphorus Content of Estuarine Waters of the Chesapeake Bay near Solomons Island, Maryland. Sears Foundation: Jour. of Mar. Res. 3, 1: 76–88.

—— 1940. Studies on the Phosphorus Content of the Estuarine Waters of Chesapeake Bay. Proc. Amer. Philos. Soc. 83: 621–630.

HARALD H. NIELSEN, Ohio State University

Grant No. 381 (1939). Measurement of the infra-red absorption band spectra of polyatomic molecules under high dispersion.

A grant of five hundred dollars ($500) was made by the American Philosophical Society in 1939 to aid in the building of a high dispersion vacuum infra-red spectrometer of very superior quality. The funds made available were used to buy a calibrated circle, twenty-four inches in diameter. The circle was to be calibrated with divisions separated by five seconds of arc; it was delivered some three months ago.

In the meantime most of the other parts, such as mirrors, mirror-holders, gratings, galvanometers and thermocouple have also been gathered together. The plans for the spectrometer are in an intermediate state but it is hoped to have the working plans completed within a few weeks and to have the instruments in the shops by early spring. It is hoped to purchase the vacuum tank in which the spectrometer is to stand soon after the beginning of the new year.

The instrument is to be of an optical quality sufficiently good to resolve spectral lines separated by an interval of .1 cm^{-1} and is to be used principally to study the rotational fine structure splitting of lines arising out of the interaction between the rotational and oscillational motion of the molecules.

Although no publications have resulted from this grant to date, it is expected after the instrument is in operation that the investigations will extend more or less indefinitely over a period of several years.

EUGENE PACSU, Princeton University

Grant No. 365 (1939). Measurements of the dissociation constants of mono-, di-, tri-, tetra-, penta-, hexa- and heptaglycine.

The observations of E. Pacsu (Nature, 144: 551 (1939), and unpublished experiments) on the condensation of polyglycine esters suggested the possibility of discontinuities in properties among the polyglycines which might have some importance in relation to the problem of protein structure. It was desirable, therefore, to search for discontinuities in the physico-chemical properties of the simpler polypeptides and if possible to interpret their significance. The dissociation constants of the acidic and basic groups of an amino acid are a function of their distance apart, a property which might be of some interest. Measurements were therefore made of the dissociation constants of mono-, di-, tri-, tetra-, penta-, hexa- and heptaglycine. The electrometric titration procedure was employed and the potentials were determined by means of the glass electrode. The basic dissociation constants of the esters of mono-, di-, tri-, tetra- and hexaglycine were also measured for purposes of comparison with those of the corresponding acids. Attempts to prepare the ester of pentaglycine were unsuccessful, for under the experimental conditions the alcohol attacks the peptide linkages and causes splitting into shorter chains.

The results for the first five members of the glycine series were normal, indicating a steadily increasing distance between the charged end-groups, but with the sixth and seventh members, i.e. hexa- and heptaglycine, a marked change was observed. The dissociation constants of the ammonium-ion acids indicated two possibilities: (1) that between the fifth and sixth members of the polyglycine series of acids there is a large increase in the distance between the end-groups, and (2) that whereas in the first five members

the dual-ion has the same structure as the negative ion, this is not the case with hexa- and heptaglycine. According to Glasstone and Hammel,[1] who carried out the experimental measurements, the former explanation of the results appears improbable, since the charged groups are already so far apart that any further increase in distance will have little effect on the dissociation constants, but the latter possibility can be supported by Wyman's results on the dielectric increment of the members of the polyglycine series.

ROBERT W. PENNAK, University of Colorado

Grant No. 314 (1939). The comparative limnology of north-central Colorado.

The northern Colorado lake district, which has an area of 8761 sq. km., may be divided into four distinct limnological zones with reference to altitude and lake typology. The Plains zone includes 165 bodies of water situated east of the base of the foothills at altitudes of less than 1700 m. above sea level. The Foothills zone, from 1700 to 2500 m. high, contains only 14 lakes. The Montane zone, between 2500 and 3200 m., includes 72 lakes. The Alpine zone, more than 3200 m. high, contains 135.

One of the problems investigated during 1940 at the University of Colorado Limnological Laboratory was the annual cycle of chemical, physical, and biological phenomena in Boulder Creek, a typical mountain stream. It was found that the stream flow varied enormously, from 0.87 to about 300.0 cubic feet per second, depending on rainfall and melting snows in the adjacent mountains. Dissolved free carbon dioxide was relatively constant, being in approximate equilibrium with the carbon dioxide tension of the air. The amounts of bound carbon dioxide, however, were somewhat dependent on the amounts of melting snow and rain; during the summer months when the stream was high bound carbon dioxide averaged about 13.0 p.p.m., but during the fall and winter when the stream was low the average was about 25.0 p.p.m. Dissolved oxygen averaged complete saturation, although the range was from 86 to 107 per cent saturation. The total dissolved solids in the stream averaged 73.7 mg. per l. and 24 per cent of this amount was organic material. The pH of the stream remained surprisingly constant; the range was from pH 7.0 to pH 7.9, but readings above

[1] Glasstone, S., and E. F. Hammel. Jour. Am. Chem. Soc. 63: 243 (1941).

pH 7.4 were confined to the spring months. A true rheoplankton was almost absent, being limited mostly to a few rotifers, copepods, and diatoms. The stream usually carried quantities of filamentous green algae, however, which had been torn loose from the rocks on the bottom.

A second problem investigated was the diurnal migration of plankton Crustacea in Summit Lake, a body of water above timber line in the Alpine zone having a maximum depth of 13.2 m. Diaptomus shoshone and Daphnia pulex were the only plankton Crustacea encountered. The former species showed a well-defined diurnal migration, with the majority of these organisms confined to the uppermost 6 m. of the lake between 6 P.M. and 3 A.M. and to the lowermost portions of the lake during the rest of the day. Daphnia pulex showed a poorly-defined, although similar, diurnal migration pattern.

An intensive year-round investigation of four small reservoirs is also being undertaken. Three of these bodies of water are in the Plains zone and one is in the Foothills zone. The field work associated with this study will be completed in the spring of 1941, but important results are already apparent. The reservoir which has the smallest inflow and outflow of water has the lowest plankton productivity and the lake which receives little water has by far the greatest plankton productivity. Oxygen exhaustion may occur in the bottom waters of the two most productive lakes, but since they are shallow these conditions may disappear under the influence of strong winds.

In addition, about twenty lakes in the Montane and Alpine zones were visited for the first time and significant chemical, physical, and biological data were gathered for laboratory analyses. This makes a total of sixty-two different bodies of water which have been studied in northern Colorado.

Pennak, R. W., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 272–273.

Willard V. Quine, Harvard University

Grant No. 385 (1939). Completion of a treatise entitled "Mathematical Logic."

The naïve form of set theory was shown by Russell (1901) to involve contradictions. The two worthiest rivals for the succession

have been Russell's own theory (1908) and von Neumann's (1926). Under Russell's theory the numbers and other entities of mathematics and logic lose their uniqueness, each giving way to an infinitude of replicas. These unnatural cleavages necessitate elaborate technical manoeuvres, by way of partially reëstablishing the severed connections. Another drawback of Russell's theory is that the formulae which made sense under naïve set theory come in large part to be rejected as meaningless. Von Neumann's theory is free from these faults; it dodges the contradictions by a different device, viz., by declaring certain sets incapable of membership in any sets. But since in Russell's theory all sets which are recognized at all are capable of membership, von Neumann's theory remains disadvantageous insofar as it bars from membership any sets recognized by Russell; and this disadvantage does prove considerable.

I found that these reciprocal disadvantages could be overcome, and the merits on both sides retained, by adhering to von Neumann's general approach but radically revising the conditions under which sets are to be capable of membership. Under the revised conditions, which bear a certain formal analogy to Russell's conditions of meaningfulness, all sets recognized at all under Russell's theory become capable of membership: and so do many others. What is gained is not only simplicity and technical convenience, but also, in one direction at least, power: infinite sets capable of membership can be proved to exist without *ad hoc* postulation.

A comprehensive new presentation of mathematical logic seemed desirable in view of these findings—and in view, as well, of important advances which had been made in other quarters in the years since Whitehead and Russell's *Principia Mathematica* became the standard work. Greater economy of primitive ideas was now known to be attainable, and greater simplicity in the definitions and axioms. Marked enhancement both of rigor and of clarity, also, had been made possible by the rise in the past decade of logical syntax. And new extensions of theory called for systematic incorporation—notably Gödel's incompleteness theorem.

A grant from the Penrose Fund of the American Philosophical Society provided secretarial assistance.

QUINE, W. V., 1940. "Mathematical Logic." xiii + 348 pp. W. W. Norton and Co., New York.

JUAN B. RAEL, Stanford University

Grant No. 404 (1940). Gathering of linguistic material, folk music and other forms of folk-lore in southern Colorado and northern New Mexico to supplement materials collected by the writer on previous field trips.

In an expedition to a region in southern Colorado and northern New Mexico, in the summer of 1940, the following Spanish folk-lore materials were collected:

1. 535 *coplas* (strophes consisting of four eight-syllable lines with assonance on the second and fourth verses). Most of the *coplas* are really independent short poems dealing with almost any subject, especially love. All are anonymous and with the exception of 183 of them, which were taken from the old numbers of New Mexican-Spanish newspapers, they were all gathered from oral tradition.

2. 27 other popular poems, including 5 ballads, 8 tongue twisters in rhyme and 8 *décimas* (poems with five stanzas, the first one being a quatrain and the last four, ten-line strophes).

3. 26 *alabados* in manuscript form. These are popular religious hymns ordinarily sung at wakes or at the ceremonies of the *penitentes* (flagellant brothers). No effort was made to gather more because the collection on hand was already quite complete.

4. A manuscript of the *Vía Crucis* used by the *penitentes*.

5. Notes on religious feasts and other customs.

6. 30 popular proverbs.

7. 86 riddles.

8. 94 folk-tales. These, just as the proverbs and riddles, were collected from the lips of the Spanish-speaking population of the region.[1]

9. Sound recordings of 224 old folk melodies, including 60 *valses de cadena* or chain waltzes (so called because during the first half of the melody, the dancing couples form a circle or chain and move around, keeping time with the music, after which they break off from the circle and waltz around), 16 other dance melodies, 12 marches, 69 *alabado* melodies (sung without music), 19 tunes oc-

[1] These tales will be published in the Appendix Number of the writer's collection of 410 folk-tales which are now being published serially in the *Journal of American Folk-Lore*, under the title of "Cuentos Españoles de Colorado y de Nuevo Méjico," of which the first series has already appeared in Nos. 205–206, July–December, 1939.

curring in the three religious folk plays *Los Pastores, El Niño Perdido* and *Los Reyes Magos.*[1]

10. One manuscript of *Los Comanches*, a folk play.

11. One manuscript of *Los Reyes Magos.*

12. Linguistic material in the form of vocabulary and notes on word usage.

The above material is being utilized for several studies which the writer has under way.

GORDON N. RAY, Harvard University

Grant No. 477 (1940). An authorized and definitive edition of "The Collected Letters of William Makepeace Thackeray."

Though it is nearly eighty years since the death of Thackeray, hardly a fourth of his extant letters have been printed in a form that approaches completeness. Even these few are available only in corrupt and drastically censored texts. The reason for this situation is not far to seek. Because of the painful, though in no sense discreditable, nature of certain episodes in Thackeray's experience, his descendants have been unwilling to permit the publication of his more intimate letters. In consequence, less is known about his private life than about that of any other major Victorian writer.

It has now become possible to supply this deficiency. The literary rights to Thackeray's unpublished letters, as well as the copyright of many of his published letters, are vested in his granddaughter, Mrs. Hester Thackeray Fuller. The writer has Mrs. Fuller's authorization to prepare a definitive edition of Thackeray's correspondence. She has agreed, moreover, to the publication of the material in her possession—the indispensable nucleus of such an edition—which includes some 325 letters from Thackeray to his family, 75 letters from Thackeray to Mrs. Procter, 16 diaries kept by Thackeray at various times during his life, and a number of letters to Thackeray. American owners of other important Thackeray correspondence are also allowing their holdings to be used,

[1] The sound recordings were made partly with a recording machine belonging to the Music Division of the Library of Congress and partly with a recording machine belonging to the Adams State Teachers College of Alamosa, Colorado. In recording the tunes, J. L. Kittle, Dean of the College and Professor of Music, gave the writer valuable assistance.

and the writer has now assembled photostats or transcripts of nearly 1,350 letters.

The edition is to be published by the Harvard University Press, beginning in 1942. It will extend to four large octavo volumes of more than 500 pages each. The abundant drawings with which Thackeray enlivened his correspondence will be reproduced by means of line cuts, and there will be many full page illustrations selected from hitherto unpublished sketches by Thackeray of himself and his chief correspondents.

FRANCIS OWEN RICE, Catholic University of America

Grant No. 308 (1939). The synthesis of certain polynuclear ring systems.

The behavior on heating of cyclohexene derivatives containing an unsaturated side chain has made it necessary to synthesize these in larger quantity in order to obtain pure substances, and to study the effect of heat on them at low pressures and high temperatures.

A large steel bomb of 50-liter capacity has been fitted up so that condensations can be carried out in the temperature range 200–400° C., and at 10–100 atmospheres. With this bomb a considerable amount of fairly pure product can be obtained in a single run by allowing the reaction to proceed to the extent of only 10–15 per cent.

The products obtained are decomposed at low pressures in a quartz flowing system and the new products are identified and estimated. We are still in the preliminary stages of this work and are endeavoring to correlate these reactions with the principle of least motion before trying to build larger compounds.

RICE, FRANCIS O., 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 276–277.

F. K. RICHTMYER,† Cornell University

(Work continued by L. G. PARRATT, Cornell University)

Grant No. 342 (1939). Double ionization of atoms and the Auger effect.

For twelve years Professor F. K. Richtmyer persistently studied the numerous but unspectacular faint lines in x-ray spectra. Because of their unknown origin these lines were known as "satellites." It was largely through the fruition of Professor Richtmyer's work that the inner-atomic dynamics giving rise to these enigmatic satellites were revealed, an extremely significant addition

† Deceased November 7, 1939.

to our masonry of atomic structure. Professor Richtmyer's last work, begun under the current grant and continued under the supervision of the writer after Professor Richtmyer's death, demonstrates unquestionably that x-ray satellite lines arise from transitions between atomic energy states of double ionization (two inner electrons missing) and that the transition probabilities (satellite intensities) are intimately associated with a process known as the Auger effect, a process previously considered as extraneous to x-ray spectral phenomena.

Specifically, in this work, Dr. R. E. Shrader completed the studies: "The Relative Intensities of $L\alpha$ Satellite Lines for Atomic Numbers 73 to 92" and "The Excitation Potential of the $L\alpha$ Satellites for Gold," and two papers with these titles are to be published soon in the *Physical Review*. Dr. J. N. Cooper, using the same apparatus as used by Dr. Shrader—apparatus constructed in previous years with the aid of grants from the American Philosophical Society in 1934 and 1937—has made a study: "The Auger Effect in Relative Intensities and Widths of X-Ray Lines," and a paper with this title is to be published soon in the *Physical Review*. Dr. Cooper's work has been presented in two papers before two meetings of the American Physical Society, one at Washington, D. C., in April 1940, and one at Philadelphia in December 1940.

Although the series of investigations for which the grant was made has reached a logical termination, this conclusion, as in any fruitful research, merely opens up and effectively broadens the field of endeavor. In particular, the atomic forces and factors that have been so studied in the x-ray wavelength range of 0.5 to 2 Angstroms appear now to be more profitably and crucially pursued in the wavelength range of 2 to 200 Angstroms. This wavelength region is practically virginal and new instruments and techniques are required.

Part of the work of the current year has been devoted to the design and assembly of a high-current low-voltage power supply for a rotating target x-ray tube; and a specially designed bent-crystal focussing spectrometer has been constructed for the long wavelength rays. Approximately one third of the salary of Mr. J. W. Trischka, my assistant, who has worked on these assemblies, has come from the current grant. Mr. Trischka and I plan to report to the American Physical Society in April at Washington, D. C., on "A New Electronic Method for Maintaining Very Constant X-Ray Voltage." We plan to test the spectrometer more thor-

oughly before making a formal report of its features and performance.

KENNETH R. ROSSMAN, University of Iowa

Grant No. 459 (1940). Biography of Thomas Mifflin (1744–1800).

The manuscript materials relating to my subject are scattered in various collections: the *Pickering Papers*, Massachusetts Historical Society; the *Emmet Collection*, and *Sam Adams Papers*, New York Public Library; the *Gates Papers*, New York Historical Society; the *Cadwalader Papers*, *Gratz Collection*, *Washington-Biddle Correspondence*, *Wayne Papers*, Historical Society of Pennsylvania; the *Papers of Washington*, and *Papers of Continental Congress*, Library of Congress; the *Revolutionary War Collection* of the War Department, The National Archives; and the *Greene Papers* in the William L. Clements Library, and the Henry E. Huntington Library. In the summer of 1939 I had already examined a great many of these (and other) sources, and now, as a result of this grant, I was able to complete my investigation.

Clearly, although only a secondary figure in a period studded with great men, Thomas Mifflin was an outstanding patriot, soldier, and statesman. His years, 1744–1800, spanned some of America's most interesting and decisively important history. Of especial interest is the early part of his career, for its own sake as well as for the light it throws on Pennsylvania and continental politics, and military history and intrigue.

Mifflin, for example, was in the circle of those implicated in the so-called Conway Cabal, that vague effort to remove Washington from supreme command. At the time he suffered a severe loss of prestige. Although a known critic of Washington, he was vehement in his denials of complicity in any conspiracy, or of disloyalty to him. As far as the evidence shows, there is no reason to doubt his sincerity. The charge was a bogey which haunted him for the remainder of his life.

ROBERTS RUGH, Washington Square College, New York University

Grant No. 336 (1939). (*a*) Developmental effects resulting from exposure to x-rays and (*b*) development of leopard frog eggs activated by bullfrog sperm. (This work was carried out in collaboration with Frank Exner, Department of Cancer Research, Columbia University.)

Following the suggestions of the previous work, also supported by a grant from the Penrose Fund, a separation of the two func-

tions of the spermatazoan (i.e., activation and hereditary contribution) was attempted by irradiation of bullfrog sperm prior to inseminating leopard frog eggs. Under normal conditions this hybrid cross invariably causes the death of the embryo at about the time that gastrulation would occur, but when irradiation is carried up to 66,000 r. as many as 80 per cent of the embryos hatch and develop into tadpoles. Most of these tadpoles are obviously haploids, manifesting those characteristics normally associated with tadpoles parthenogenetically developed. Some, however, appear as normal as the controls and such chromosomal observations as were possible indicate a normal (diploid) number of chromosomes, probably entirely maternal. The stages of development reached by the embryos in relation to the x-ray exposure of the sperm suggest that the abolition of the hereditary function of the sperm is progressive rather than abrupt. Since bullfrog sperm exposed to 66,000 r. can only activate the leopard frog eggs, parthenogenesis has been successfully achieved in 97 per cent of such cases.

These foundation papers indicate that in amphibian gametes we may have excellent material for (*a*) analysis of nucleo-cytoplasmic relations, (*b*) x-ray assay by biological material, having in mind spectral phenomena, (*c*) induction of mutations and embryological aberrations and (*d*) a test for K — IT where a biological system is involved. Much further work is therefore contemplated.

Rugh, R., 1939. Developmental Effects Resulting from Exposure to X-rays. I. Effect on the Embryo of Irradiation of Frog Sperm. Proc. Amer. Philos. Soc. 81: 447–471.

—— 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 278–279.

Edward Sapir,† Yale University

(Work continued by Harry Hoijer, University of California at Los Angeles)

Grant No. 163 (1937). The collection of Navaho folk-lore.

The funds supplied by this grant were used by Dr. Sapir and myself to employ a Navaho Indian to collect and write up, in his native language, the myths and tales of his people. It was felt by Dr. Sapir that data of this sort, collected by a native informant, were likely to supply information on the language not available to a foreign researcher who did not speak the language. Several

† Deceased February 4, 1939.

hundred manuscript pages of text have been collected with the aid of the fund and, though the data have not yet been sufficiently studied to make possible a complete statement of the results, it is evident that these are of considerable importance. It is hoped that the material may be made ready for publication in the near future.

About one hundred dollars of the grant were expended in the preparation for publication of a larger collection of Navaho myths made by Dr. Sapir himself. This publication, "Navaho Texts," by Edward Sapir, with supplementary texts by Harry Hoijer, is probably to be published some time in 1941 by the Linguistic Society of America in the William Dwight Whitney Linguistic Series.

FREDERICK A. SAUNDERS, Harvard University

Grant No. 348 (1939). Mechanical action of old and new violins.

Our studies of violins here began with measurements of the harmonic content of the tones of good and bad violins. To our surprise the results indicated that there was no striking difference in tone quality between the new violins of good construction and the best of the old masters. All these measurements were made on steady tones, ignoring anything peculiar that might occur at the beginnings and the ends of the tones. To complete the attempt to discover the difference between old and new violins a special study of these transient effects had to be made for which special equipment was required. Part of this was a high-speed camera purchased by the American Philosophical Society grant.

Using an especially built small condenser microphone, obtained from the Bell Laboratories, a very quick-acting amplifying circuit and the high-speed camera, the motion of the spot in a cathode ray oscillograph in the output of the circuit was photographed. With these the cathode beam of the oscillograph could be moved at frequencies up to 10,000 cycles per second and good traces of these vibrations obtained on a moving film whose speed was variable between five and thirty feet per second. Our usual speed is about ten feet per second. This arrangement is extraordinarily good for the purpose of studying the growth and decay of sounds.

This new phase of the work was begun by asking Mr. Jascha Heifetz to play a rapid staccato finger exercise while we took a record of the sound. This he did to perfection, playing about

thirteen short sharp notes per second, and he did this first on his magnificent Guarnerius and later on a $5 violin which is as bad an instrument as we could find. The result of these records was to find that the Guarnerius took a 30 per cent longer time to grow to its maximum of tone volume each time the bow touched the strings than the $5 violin did, though the Guarnerius produced a greater volume of tone. The experiment was repeated by asking Mr. Bernard Robbins of the Stradivarius Quartette to play on his Stradivarius and again on the $5 violin. The record of his similar finger exercise done at high speed was that there was very little difference this time between the Stradivarius and the $5 instrument.

These two experiments were, however, not satisfactory. The tones were so complex and the wave forms changed so greatly during the growth or decay of the sounds that it was almost impossible to make accurate measurements on the rates of decay. Therefore it was decided to excite the violin by a single frequency excitation. A method finally developed involved sending an alternating current through a metal string which replaced the usual "G" string of the violin. The current was of the order of one ampere and its frequency could be varied from 50 to 15,000 cycles per second. The wire passed through a field (10,000 Gauss) furnished by a direct current magnet mounted as close as possible to the bridge of the violin. The wires themselves were damped by means of cotton. This gave us a pure alternating force acting on the bridge and hence on the body of the violin with sufficient strength to produce a fair volume of tone.

An instrument with the trade-name of Audiograph, which we already possessed, enabled us to write a response curve of the violin directly, the tone picked up by a microphone being amplified and thus moving a pen while the frequency was being continuously varied. The resulting curves are of interest in themselves as greatly improved response curves which indicate the natural vibrations of the violin body. This method of excitation is, however, of special use to us in connection with this study of the growth and decay of sound. By choosing a single frequency at which the violin responds loudly and exciting the violin through a key which could be closed and opened, we could get records of the growth and decay at one frequency only. These records are smooth and furnish

accurate measures of the damping effects due to the viscosity of the wood and of the varnish.

The results of these latest experiments show a very definite inferiority in the $5 violin. The decay in better violins is less rapid, thus allowing the tone to ring for a longer time. There are, however, a few well made modern violins which act as well as some old ones in this respect. This phase of the subject is being actively pursued at present, and will be completed soon.

A paper by R. B. Watson, W. J. Cunningham, and F. A. Saunders is to appear shortly in the *Journal of the Acoustical Society of America* covering the new technique with an indication of the first results.

KARL SAX, Harvard University

Grant No. 318 (1939). The effect of radiation on chromosome structure.

Irradiation of somatic cells by X-rays produces many types of chromosomal aberrations. Dicentric and ring chromosomes are associated with the loss of chromosome segments, as are the terminal deletions. Other types of alterations such as reciprocal translocations and inversions involve only chromosome rearrangement with no loss of chromosome material. Although these two general classes of aberrations occur with about equal frequency, the only types of aberration which survive in somatic development are those which involve only chromosome rearrangement. Apparently the loss of a large chromosome segment is cell lethal even in the heterozygous condition, or these aberrant cells are unable to compete with cells containing normal or balanced genoms.

A study of successive nuclear divisions in Allium root tips following irradiation shows that the cells containing dicentric or ring chromosomes are able to divide for several cell generations, but eventually they are eliminated. The balanced genoms do survive and presumably many of the minute deficiencies also are viable in the heterozygous state, although they may act as lethals or semilethals in the homozygous condition.

It is evident that the production of unbalanced genoms by irradiation of seedlings is not likely to be successful. This conclusion is borne out by earlier experiments in which about fifty species of ornamental plants were subjected to X-rays in the seedling stage. Although abnormal growth resulted, the plants eventu-

ally recovered and showed no abnormalities which might be associated with gross disturbances of the chromosome balance.

Spontaneous chromosomal aberrations occur occasionally and attempts have been made to associate such alterations with abnormal growth. The study of X-ray induced aberrations indicated that deleterious alterations would not survive for many cell generations. In triploid corn endosperm, however, such unbalanced genoms do persist, but in triploid Tradescantia plants the deficient genoms are eliminated in somatic development.

SAX, KARL, 1941. The Behavior of X-ray Induced Chromosomal Aberrations in Allium Root Tip Cells. Genetics, 26: (In press).

EDWARD JAY SCHREMP, Washington University, St. Louis

Grant No. 387 (1939). Investigation of the fine-structure pattern of directional cosmic-ray intensity at Mexico City.

In August, 1940, a cosmic-ray coincidence telescope of high angular resolution and large areal aperture was taken from St. Louis, Missouri, to Mexico City, Mexico, for the purpose of comparing the intensity pattern at the two places. The telescope has remained in continuous operation at Mexico City, and up to the present has yielded the zenith angle intensity distribution in the eight azimuths N., NE., E., SE., S., SW., W., NW., from zenith angle $z = 0°$ (the vertical direction) to $z = 54°$. Further measurements are now under way to interpolate and improve the results thus far obtained.

As was to be expected from the lower geomagnetic latitude of Mexico City ($\lambda = 29°$ N.), the pattern found there differs markedly from that found at St. Louis ($\lambda = 50°$ N.). Whereas the pattern at St. Louis has been shown to be essentially symmetric about the zenith direction, consisting of three circular rings of intensity prominences at $z = 7°$, $20°$, $35°$, the pattern at Mexico City does not possess the same complete circular symmetry about the zenith. The Mexico City pattern possesses, instead, two maxima of intensity symmetrically disposed at about 15° west and east of the north-south azimuthal plane, and a few degrees south of the east-west azimuthal plane. The western maximum is nearly 30 per cent greater than the zenith intensity, and the eastern maximum is about 5 per cent less. Other characteristics of the Mexico City

pattern are a circular ring of intensity prominences at $z = 42°$, and an excessive intensity in the north-south and east-west azimuthal planes as compared with the northwest-southeast and northeast-southwest azimuthal planes.

The existence of the two maxima observed at Mexico City, with positions which are mirror images in the north-south plane, strongly supports the thesis of the author that the primary cosmic radiation consists predominantly of particles of the same e/m but opposite charge, and hence of positive and negative electrons. The relative abundance of positive and negative electrons is roughly indicated by the ratio of intensities of these two maxima, i.e., 130 to 95.

The circular ring of intensity prominences at Mexico City, at $z = 42°$, corresponds to those observed at St. Louis, except for its different position. The interpretation of this circular prominence, as also of those at St. Louis, is that the circular ring indicates a line or band in the primary energy spectrum, too energetic to be affected by the earth's magnetic field, but coming into evidence through atmospheric absorption alone. The difference in character of the rings at Mexico City and St. Louis may be laid to the difference in altitude of the two stations.

Finally, the excess of intensity in the north-south plane, referred to above, may be interpreted as arising from the existence, in the energy spectra of both positive and negative primaries, of a wide band of low energies, cutting off at an energy corresponding to an allowed cone which opens just to the east of the north-south plane for positive particles, and just to the west for negative particles. The resulting overlapping of the positive and negative particle cones would then explain the observed behavior. As can be seen, this experimental observation should shed light on the forms of the spectra at lower energies.

This work at Mexico City is to be reported from time to time in letters to the *Physical Review*. After its completion, it is proposed to continue with studies elsewhere in Mexico, at points of different altitude, so that the effects of absorption alone can be ascertained for the same low geomagnetic latitude.

SCHREMP, E. J., 1940 (with BAÑOS, ALFREDO, JR.). On the Fine-structure Pattern of Cosmic Rays at Mexico City. Phys. Rev. 58: 662–663.

—— 1941. On the Fine-structure Pattern of Cosmic Rays at Mexico City, II. Phys. Rev. (Submitted for publication.)

NEVIN S. SCRIMSHAW, Harvard University

Grant No. 422 (1940). Study of the factors influencing the reproductive cycle and ovarian content in poeciliid fishes; study of the physiology of viviparity in poeciliid fishes especially the origin of the nutriment used by the embryo and the manner of its incorporation.

This grant provided for two months work on Barro Colorado Island in the Canal Zone and near-by areas in the Republic of Panama. Field observations were made of the environmental conditions and their effect on the reproductive cycle and the ovarian content in seven species of poeciliid fishes. Several hundred specimens were studied to determine the normal ovarian picture in the rainy season. These will be checked by the study of collections made periodically in the dry season.

Five of the species were shipped back alive to the Biological Laboratories at Harvard University and are being used for experimental work on the effect of light, pituitary hormones, temperature, food and other factors on reproduction and metabolism. This work is being interpreted with the aid of the data secured from the summer field work.

The nature of embryonic growth in seven poeciliid fishes was studied from abundant living material. Embryos of one species secured in Panama were found to obtain most of their nourishment from the mother by a very intimate pseudo-placental attachment. This species is valuable for the study of embryonic nutrition because its embryos are large enough for direct microchemical analysis. These fish were secured in adequate numbers for the preliminary field study and enough shipped back alive to make possible the tracing of specific food substances from mother to embryo.

A number of additional species of fish were recorded for the region and a new report on the fishes of Barro Colorado Island and their distribution is being prepared.

HARRY R. SEIWELL, Woods Hole Oceanographic Institution

Grants No. 269 (1938) and No. 378 (1939). Investigation of internal waves in the North Atlantic Ocean.

As a consequence of an internal wave mechanism, short period vertical oscillations of the water particles cause time variations of oceanographic properties (temperature, salinity, etc.) at fixed points throughout the ocean space. Observations on the phenom-

ena from a ship anchored on the high seas have been taken continuously over periods ranging from twenty-five hours to two weeks, and in February 1940, the previous eleven deep anchorings of *Atlantis* were supplemented by measurements while anchored for approximately forty-eight hours in the Gulf Stream off Cape Canaveral, Florida.

Magnitudes of the vertical displacements, along fixed verticals in the sea, change from day to day, with consequent diversity in daily ranges of physical and chemical properties at fixed points. Thus for example, thirteen days of continuously repeated measurements at a position (*Atlantis* 3091) about 110 miles northwest of Bermuda, at standard depths (between 50 and 1300 meters depth) have brought out that minimum 24-hourly temperature ranges varied between 0.06° and 0.90° while 24-hourly maximum ranges were between 0.26° and 2.50°, minimum temperature ranges resulted from vertical displacements of 5 to 42 meters and maximum from displacements of 28 to 149 meters.

As a result of internal waves representative structural pictures of oceanic areas are not generally obtained from isolated individual samplings of the water masses. However, disturbances appear to be insufficient to invalidate use of customary dynamic methods for computation of the broad general features of ocean currents, although consideration of detailed variations are frequently to be taken with a "grain of salt." Accuracy of patterns, prepared to illustrate dynamic states of the sea (dynamic topographies, current velocities, etc.), may be augmented by use of controlled data, and possible errors which may arise in computations of dynamic elevations of equal pressure surfaces, horizontal current velocities and water transports have been discussed for both the Western Sargasso Sea and for the Gulf Stream. In the Sargasso Sea, where dynamic slopes of equal pressure surfaces are not great and where horizontal current velocities are relatively weak, time variations of oceanographic properties are sufficient to cause discrepancies in computed average velocities up to 3.0 to 3.5 centimeters per second, or 50 to 100 per cent of computed average surface values. In deeper water (where even lower velocities prevail) percental variations increase, obtaining up to, approximately, 200 per cent at 1000 meters depth. In the Gulf Stream a somewhat similar situation prevails, for example, short period variations in current velocities of approximately 20 per cent were inferred for a computed average surface velocity of 135 centimeters per second in the axis of the current off Montauk Point.

Theoretical investigation of internal waves in a sea of continuously varying density, using methods proposed by Fjeldstad, considers computation of possible internal waves for a given density distribution by numerical integration of the second order differential equation:

$$\frac{d^2W}{dx^2} + \lambda^2 g e W = 0$$

with boundary conditions

$$W = 0, \quad x = 0, \quad \text{at the bottom,}$$
$$W = 0, \quad x = h, \quad \text{at the surface,}$$

when W represents the vertical elevation of a particle from its equilibrium position. The infinite number of solutions of the equation corresponds to an infinite number of internal waves. Four orders of waves appear to be adequate to represent vertical variations, and theoretical amplitudes and phases determined by least squares are in fair agreement with those obtained by harmonic analysis of observed displacements.

To transform the observations into patterns appropriately indicating their average state and space variability, statistical techniques identified with somewhat analogous geophysical phenomena have been used. Application of probability theory to results of harmonic analysis of observations (between surface and 1200–1300 meters) illustrates dominance of 24 and 12 lunar-hour sine-waves in vertical oscillations of the water particles, although the physical nature of the phenomena is not involved. Both amplitudes and phases of vertical displacements vary continuously with depth, being identified with the internal structure of the water column, and vertical transitions closely parallel density stratification. The two groups of coefficients (for the observational interval) are conveniently represented as point aggregates in the "harmonic dial" of Bartels, and computation of their geometric properties brings out essential basic distinctions for the two frequencies. Likewise additional significance is given the analysis by comparison of observed and theoretical values, both having essentially the same statistical properties.

Contribution No. 264, Woods Hole Oceanographic Institution.

SEIWELL, H. R., 1940. Anchoring Ships on the High Seas. U. S. Naval Inst. Proc. 66, 12: 1733–1740.

—— 1940. Preliminary Results of Measurements of Temperature and Salinity Variations in the Gulf Stream: March, 1940. Amer. Geophys. Union, Trans. of 1940. Section of Oceanography: 349–352.

—— 1940. Time Variability of Hydrographic Elements Determining the Dynamic Situation in the Western North Atlantic. Proc. Amer. Philos. Soc. 82: 369–394.

JAMES A. SHANNON, New York University

Grant No. 304 (1939). The relationship between the renal tubular reabsorption of water and the anti-diuretic principle of the posterior pituitary; and the effect of the composition of the body fluids upon the latter variable.

During the past year we have completed the functional work-up of a series of dogs with permanent diabetes insipidus, the result of operative ablation; and have extended our observations on the normal dog. Briefly the results of this work are as follows:

1. A technique has been developed which permits the continuous administration of the antidiuretic hormone over a period of hours without discomfort to the animal. Utilization of this technique has led to a clarification of the rôle of the antidiuretic hormone in conditioning the reabsorption of water and electrolytes and has permitted a preliminary evaluation of the rate at which this hormone is normally liberated.

2. The rate of formation of the antidiuretic hormone probably does not exceed 0.005 to 0.020 units per hour (pressor units) in the normal dog (15 kg.) during moderate dehydration.

3. The effectiveness of antidiuretic activity of a standard dose is determined largely by the rate of formation of glomerular filtrate, the concentration of total base in the plasma and the ability of the renal tubule, presumably proximal segment, to reabsorb sodium. These factors which have to do with glomerular and proximal tubule function presumably condition activity in the distal segment by determining the volume and composition of tubular fluid presented to this segment.

4. Work on the normal dog indicates that these factors together with the functional relationship between the volume of extracellular fluid and the volume of plasma on the one hand and between the plasma volume and glomerular filtration rate on the other are important in the control of the volume of extracellular fluid.

HERBERT SHAPIRO, Vassar College

Grant No. 440 (1940). Studies on the physiology of development.

Investigations on the activation of rabbit eggs *in vivo* in the Fallopian tube, have been continued, using the method devised by

the writer, and previously published. A new approach to activation has been attempted by warming the eggs *in vivo*, within several hours after ovulation, under sterile surgical conditions, and then allowing the animals to recover. As the result of more than thirty experiments of this type (some done in collaboration with Dr. G. Pincus), there is no final evidence that advanced embryos have been secured, but examination of the contents of the tubes within about a day after the operation indicates that heating initiates development *in vivo*. Another method of attack has been to alternately cool and heat the eggs. Both types of experiment are being continued.

At the Marine Biological Laboratory, Woods Hole, a study was made of the effect of the respiratory poison potassium cyanide on the oxygen uptake by fragments of the egg of Arbacia punctulata. The light unfertilized halves were found to be relatively unaffected by KCN, whereas the oxidative activity of the light fertilized halves was considerably reduced, and their cleavage completely inhibited. The effects of this agent were also measured on the heavy fragments.

A quantitative study was made of the kinetics of elongation and rounding up of centrifuged Arbacia eggs. The two processes were accelerated both in sea water from which calcium had been precipitated, and in artificial sea water made up without calcium. Unfertilized eggs washed thoroughly in calcium-free sea water, and then fertilized, went through first cleavage more rapidly than eggs in normal sea water, at the same temperature and osmotic pressure. This was observed quantitatively from a plot of cleavage curves; the work was reported at the general scientific meetings of the Marine Biological Laboratory, August 28, 1940.

In a joint investigation with Dr. E. Newton Harvey, a method of studying and recording by means of the motion picture camera the rounding up of egg cells which were deformed from the spherical to the cylindrical shape in fine capillaries, and then allowed to emerge, was developed. The method is being explored further, as it has important potentialities as affording another means of independently estimating the surface forces of the living cell. A preliminary account is to be given at the Philadelphia meetings of the American Society of Zoologists.

SHAPIRO, H. 1940. Elongation and Return in Spherical Cells. Biol. Bulletin 79: 364.

—— 1940. Further Studies on the Metabolism of Cell Fragments. Biol. Bulletin 79: 377.
—— 1940 (with Harvey, E. Newton.). The Recovery Period of an Arbacia Egg after Deformation. Anat. Rec. (Suppl.) 78: 64.

Francis G. Slack and Philip Rudnick, Vanderbilt University

Grant No. 399 (1940). Measurements of the Faraday Effect in nickel-sulphate alpha-hexahydrate (crystal) at low temperatures.

An investigation of the natural and magnetic rotatory powers of crystalline alpha-$NiSO_4 \cdot 6H_2O$ at liquid air temperature has been undertaken in this laboratory. Preliminary results for several visible wave-lengths are reported below.

The crystals were cooled by direct immersion in liquid "air" which was assumed to be largely oxygen. Observations were made through the double cylindrical Pyrex glass walls of the container (outside diameter 1.3 cm). The rotations actually measured ranged from 1° to 7° and satisfactory agreement was obtained between visual observations with a Lippich half-shade polarimeter, and photographic measurements by a method previously described.[1] Control measurements indicated that no serious errors arose from double refraction in the glass walls, or from lack of parallelism of the light rays in the crystal.

The results so far obtained, with corresponding room-temperature data for comparison, are as follows:

Wave-length (Angstroms)	4358	5461	5780
Natural rotatory power (degrees/mm):			
At 90° K.	+1.2	−2.0	−2.3
At room temperature[2]	+1.7	− .75	−1.25
Difference	− .5	−1.25	−1.05
Magnetic rotatory power (min/cm-oerst.):			
At 90° K.	+ .072	+ .044	+ .034
At room temperature[3]	+ .044	+ .026	+ .022
Ratio	1.64	1.69	1.54

[1] L. R. Ingersoll, P. Rudnick, F. G. Slack, and N. Underwood. Phys. Rev. 57: 1145 (1940).
[2] F. G. Slack and P. Rudnick. Phil. Mag. (7) 28: 241 (1939).
N. Underwood, F. G. Slack, and E. B. Nelson. Phys. Rev. 54: 355 (1938).
[3] F. G. Slack, R. T. Lageman, and N. Underwood. Phys. Rev. 54: 358 (1938).

The natural rotations are thus seen to be displaced in the negative (i.e. "abnormal") direction at the low temperature. The magnetic rotations, although in the positive (diamagnetic) direction, are increased at the low temperature, as in the presumably parallel case of $NiSiF_6 \cdot 6H_2O$ which has recently been observed and discussed by Becquerel and collaborators.[1] The two values just given for the Verdet constant at 5461A can be represented by the relation:

$$V = .018 + 2.3/T,$$

which agrees qualitatively with the earlier observations[2] made over a much more restricted temperature range.

We acknowledge gratefully the assistance of the American Philosophical Society in support of this investigation.

LLOYD P. SMITH, Cornell University

Grant No. 349 (1939). The electrical separation of isotopes of calcium and boron in sufficient quantities for biological, medical and nuclear investigations.

When the present research project was started it was recognized that in order to separate appreciable quantities of isotopes by electrical means two essential difficulties had to be overcome. First, an ion source had to be developed capable of yielding a large current of ions of the particular element whose isotopes were to be separated. Second, some way had to be found for preventing the enormous forces arising from the space charge of the positive ions from completely masking the applied electric and magnetic forces upon which one must rely for separating the ions of the respective isotopes.

We have been successful in overcoming the first of the difficulties mentioned above. An ion source has been developed which is capable of supplying large ion currents of a considerable number of chemical elements (those elements which exist in the condensed state at 0° C. and have appreciable vapor pressures below 2000° C.). A preliminary report on the methods used and results obtained from our source was made at the February meeting of the American Physical Society. Briefly, our method makes use of electrons which are held in a beam by a magnetic field parallel to

[1] J. Becquerel and J. Van Den Handel. Physica 6: 1034 (1939).
J. Becquerel and W. Opechowski. Physica 6: 1039 ((1939).

[2] P. G. Slack, R. T. Lageman, and N. Underwood. Phys. Rev. 54: 358 (1938).

the axis of the beam. These electrons are first accelerated and allowed to pass through a region occupied by the vapor of the chemical element to be ionized and all electrons which succeed in passing through this region without losing their energy are turned back and traverse the vapor region again. This continues until the electron loses its energy by collision with the atoms of the vapor. In this way every electron is made use of in producing ionization or excitation of the atoms. By suitable adjustment of the vapor pressure and the number and mean speed of the electrons through the vapor region the space charge in the beam can be controlled in such a way that all of the ions produced can be removed from the vapor region. In this way we have been able to obtain ion currents as high as one ampere.

To overcome the second difficulty mentioned above a part of this year was devoted to a study and development of an idea for modulating an ion beam by an impressed square wave potential of one megacycle and at the same time keeping the ion beam together and its space charge neutralized by electrons travelling back and forth through the modulating electrodes. This required the development of an oscillator which would furnish a square-topped wave at one megacycle. Such an oscillator was successfully developed and reported at the Washington meetings of the American Physical Society.

Although the idea appeared to be a very good one and the method seemed to be capable of furnishing relatively large amounts of separated isotopes, it finally became evident during the experimental work that space charge fluctuations in the electron neutralized beams were serious from the standpoint of effecting a clean separation. However, as a result of this experimental work we discovered a new method which is completely independent of the space charge produced by the positive ions. This characteristic of the method should allow us to overcome completely the second of the difficulties mentioned above, a difficulty which has always been a serious one in past attempts to use an electromagnetic method of isotope separation. The equipment for this new method is in the process of construction, and we hope to be able to give a preliminary report of its operation by the spring meeting of the American Physical Society. The method appears to be one which can be made to furnish relatively large amounts of separated isotopes, larger, I believe, than thermal diffusion methods.

The separation of isotopes has become of even more importance than at the time when this investigation was started, due largely to the fact that Li^6 promises to furnish a key to a new type of cancer therapy. Consequently, the work on this general problem is being pursued very intensively here.

SMITH, LLOYD P., 1940 (with FINKELSTEIN, A. T.). A High Efficiency Ion Source. (Abstract.) Phys. Rev. 57: 563.

—— 1940 (with PARKINS, W. E.). A High Frequency Square Wave Generator. (Abstract.) Phys. Rev. 57: 1081.

CARL CASKEY SPEIDEL, University of Virginia

Grant No. 410 (1940). Investigations with the aid of ciné-photomicrography of the reactions of cells and tissues in living frog tadpoles as the animals are subjected to various experimental conditions.

Ciné-photomicrographs of both normal and fast-motion types give an excellent permanent record of the minute histological changes in cells and tissues during and following various experimental procedures. Among the successful motion pictures made from living frog tadpoles during the past year are the following: histories of the same individual nerve endings as these undergo adjustments over a period of four weeks, changes in nerve endings throughout successive periods of good nutrition and starvation, changes in nerve endings following shock treatments with electricity and with insulin, adjustments of nerve endings near wounds and in regenerating zones of different ages, and changes in nerve endings correlated with strong anesthesia. These pictures include examples of retraction, extension, swelling, autotomy, and other features of nerve injury and recovery.

Other pictures include the experimental induction of retraction-bulb formation by bristles of the sensory cells of lateral line organs and the ensuing process of recovery; also histories of the progressive loss of large orange granules which specifically characterize these sensory cells.

Other pictures record in detail the activities of lymph vessels in salvaging extravasated red blood cells, the origin and growth of temporary sprouts, the mechanism of transfer of red cells into the lumen of the sprouts, and the final retraction of the sprouts. Extravascular and intravascular phagocytosis of erythrocytes have also been photographed.

Other ciné-photomicrographs include changes in cardiac and skeletal muscle fibers, in the epithelial and connective tissues, and in the circulation.

SPEIDEL, C. C., 1940. Ciné-photomicrographs Showing Some Activities of Various Kinds of Cells. Anat. Rec. 76 (Supplement No. 2): 95. (One reel of motion pictures exhibited at the Louisville meeting of the American Association of Anatomists.)

—— 1940. Studies of Living Nerves. VI. Effects of Metrazol on Tissues of Frog Tadpoles with Special Reference to the Injury and Recovery of Individual Nerve Fibers. Proc. Amer. Philos. Soc. 83: 349–378.

DOROTHY M. SPENCER, University of Pennsylvania

Grant No. 357 (1939). A study of the ethnology of one of the Muṇḍā-speaking peoples of India.

The people selected for this investigation are the Muṇḍās of Chota Nagpur, in the Province of Bihar. Their language is that known as Muṇḍārī. An agricultural people, depending for subsistence on their rice-fields, they are settled in small villages scattered throughout this area. Aside from this village unit the most important social groupings in Muṇḍā society are the clan, a patrilineal, exogamous group; the lineage; the household; and the family. In each village is a headman, or Muṇḍā (whence the name given to the whole caste), whose office is inherited in the paternal line. Governmental authority is however vested in all the old men of the village, who convene when necessary and settle disputes, impose fines and in some cases outcast the offender.

Economic life centers around the cultivation of rice; consequently rice fields and domestic animals used in agriculture are the chief forms of property. Although some use is made of other cultivated foods and wild vegetables, the Muṇḍās depend chiefly on rice for their food-supply. Fishing and hunting in some areas are resorted to as a means of supplementing this diet of rice. Such domestic animals as goats and fowls are an important but not regular source of food. They are necessary for sacrifice, and meat must be provided for all feasts. For most articles of material culture the Muṇḍās are dependent upon other castes. In nearly every village is a family of blacksmiths from whom agricultural implements are obtained. Cloth, earthenware pots, baskets, drums, etc., are usually purchased at the local markets. Only a few articles such as mats, bows and arrows and a few musical instruments are produced by the Muṇḍās themselves.

Religious practices may be divided into two main groups. (1) The series of annual ceremonies performed to ensure the prosperity of the people, their animals and crops. Generally the chief public rôle in these is played by the village sacrificer, a man descended in the paternal line from the oldest son of the village founder. At the same time the head of the family or household performs private ceremonies in honor of his ancestral spirits. (2) Sacrifices carried out on behalf of individuals chiefly to cure disease. In such cases the sacrifices may be performed by the head of the family or by the diviner who diagnosed the disease and directed the sacrifice. Goats, sheep and fowl, and occasionally cattle are sacrificed to the various members of the spirit world including a benevolent supreme deity.

Muṇḍā culture is rich in the materials of folklore. Myths and stories are of two types: the prose tale, and that known as the "song-story," in which songs are interspersed with the prose. In addition to these there is a large number of songs which are sung on various occasions, in connection with sacrifice, marriage ceremonies, etc. Among the arts music and dancing are the most important and each season of the year has its own appropriate dances and songs.

LESLIE SPIER, University of New Mexico

Grant No. 221 (1938). Completion of an extended ethnography of the Modoc Indians of Oregon.

An investigation of the ethnography of the Modoc Indians of Oregon was begun in 1934 by a group of six graduate students placed in my charge by the Committee on Field Training of the Laboratory of Anthropology (Santa Fé). A considerable body of data was amassed on all phases of Modoc life, which, however, could not be utilized because of lacunæ and conflicts. Further field investigation was needed to amplify, coördinate, and assess this material. Under the present grant three field trips for the purpose were made in 1938, 1939, and 1940, by Dr. Verne F. Ray (University of Washington) under my supervision.

The cultural affiliations of the Modoc, situated on the eastern California-Oregon border, have heretofore been uncertain. In general it had been assumed that they affiliated northward with the cultures of the tribes of the interior plateau of Washington-British Columbia on the assumption of identity with the linguistically re-

lated and immediately adjacent Klamath Indians, whose linkages are clearly to the north. The present investigation shows conclusively that this is in error: Modoc culture in most of its manifestations links southward with that of northeastern California.

The investigation of 1938 was devoted mainly to matters of material culture, that of 1939 to social organization and religion, and the final trip of 1940 to checking inconsistencies and completing the record. Dr. Ray was able to supplement the 1934 notes on almost every phase of culture and to resolve their dubious points. Thus the primary objective of the grant was successfully reached; to utilize the valuable elements in the 1934 notes and complete an extended ethnography of the Modoc.

Full data were secured on basic food economy, technology, clothing and bodily decoration, housing, calendrical system, rules of games, etc. An adequate, and in some respects surprisingly full, account was obtained of formal social structure, chieftainship, kinship regulations, domestic routine, and items of personal history. The religious phenomena recorded included shamanism, types of guardian spirit, seances and ceremonial practices, etc. In general the balance of relationships of Modoc culture appears to be more Californian than Plateau.

It was found, as had been anticipated, that the original voluminous records of 1934 needed meticulous checking before it could be known what elements in them were credible and valuable. Dr. Ray has checked them in conscientious fashion with informants in the field and has added a valuable body of new data. Collectively these notes provide a very full record of Modoc life and thought, and we are confident that from them a full ethnography can be compiled. Since it seemed inadvisable to publish this material piecemeal, it is Dr. Ray's intention to proceed now to write the ethnography in extended form.

WILLIAM C. STADIE, University of Pennsylvania

Grants No. 320 (1939) and No. 406 (1940). The chemical action of insulin upon the intermediary metabolism of isolated surviving tissue of normal and pathological animals.

Further work on the problem of the fat metabolism in diabetic animals along the lines reported in the last two YEAR BOOKS of the Society was continued. The problem as to whether fatty acids are

oxidized in the diabetic liver by successive beta oxidation according to the equation:

$$1 \text{ Fatty Acid} + 6.5\ O_2 = 1 \text{ Ketone Body Molecule} + 6 \text{ Acetic Acid}$$

or by multiple alternate oxidation according to the equation:

$$1 \text{ Fatty Acid} + 6.5\ O_2 = 4 \text{ Ketone Molecules}$$

was attacked in the following ways:

(1) Liver slices from diabetic cats were equilibrated for two hours and possible acetic acid formation looked for.
(2) Equilibrated diabetic liver slices were analyzed for increase of ketones and decrease of fatty acids.

No acetic acid formation whatever was found, and the molecular ratio of increase of ketones to decrease of fatty acids was found to be 3.6. Both of these observations, as were our previous experiments, are in accord with the multiple alternate oxidation hypothesis. Further evidence excluding the hypothesis that the defect in diabetes mellitus is one in which there is an excessive conversion of fatty acids to glucose in the liver was obtained. In a series of ten diabetic cats, a balance sheet of carbohydrate synthesis was obtained for liver slices by studying carbohydrate synthesis and also the protein, fat, and lactic acid metabolism. No significant amounts of new carbohydrate were formed which could not be accounted for as coming from catabolic protein, glycerol, or preformed lactic acid. Hence fats as a source of carbohydrates were excluded.

The hypothesis of obligatory coupling of carbohydrate-ketone body oxidation was further tested by the analysis of a series of clinical cases of diabetes mellitus from the literature in which the metabolic mixture of protein, fats, and carbohydrates had been determined by calorimetric methods. It was found that the so-called ketogenic-antiketogenic ratio, hitherto asserted to be the significant factor in the fat metabolism of diabetics, had no basis in fact. Moreover, this analysis showed that human diabetics were able to oxidize completely considerable amounts of fats without the simultaneous obligatory coupled oxidation with carbohydrate. In addition it was found that fat utilization was a function solely of the total fat catabolism. Dependence upon carbohydrate oxidation in the sense of some coupled molecular reaction is unnecessary.

This conclusion was in conformity with our previously reported experiments on diabetic cats.

On the basis of these and our previous experiments a simple hypothesis of the metabolism of fats in diabetes mellitus was formulated: viz., up to a certain level all fat catabolized *is completely oxidized*. Hence there is no ketonuria. Beyond this level all fat catabolized *is not completely oxidized;* hence part of the fat catabolized is excreted in the form of ketone bodies. This hypothesis was elaborated and discussed in detail in the first subjoined publication.

STADIE, WILLIAM C., 1939–40. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1938: 223–224; for 1939: 295–296.

—— 1940. Fat Metabolism in Diabetes Mellitus. Jour. Clin. Invest. 19: 843–862.

—— 1940 (with ZAPP, JOHN A., JR., and LUKENS, F. D. W.). Experimental Studies on Ketone Metabolism in the Diabetic Animal. Trans. Assoc. Amer. Physicians 55: 247.

—— 1940. Intermediary Metabolism in Diabetes Mellitus: On the Synthesis of Carbohydrate from Fat in the Liver and from Acetoacetate in the Kidney. Jour. Biol. Chem.

—— 1940. Intermediary Metabolism in Diabetes Mellitus: the Non-formation of Acetic Acid and the Ratio of Ketone Body Increase to Fatty Acid Decrease in Livers of Diabetic Animals. Jour. Biol. Chem.

ISAAC STARR, University of Pennsylvania Hospital

Grant No. 364 (1939). To ascertain and define the clinical utility of the ballistocardiogram, an instrument which records the heart's recoil and the blood's impact in man.

The grant has been used for the salary of Mrs. Caroline Hottle and, after her resignation, that of Miss Margaret Torrey, for part time technical assistance. With this assistance the writer has carried forward clinical research by means of a new method, the ballistocardiograph, which permits estimation of the approximate amount of blood pumped by the heart each minute, and so provides evidence of the amount of the circulation, and of cardiac strength or weakness, of a new and more fundamental type. The method has also proved well adapted to estimate the effect of drugs and other therapeutic agents and detect the changes brought about by the progress or healing of disease processes.

In addition, work on problems of the circulation in heart disease, hypertension, and certain other conditions has gone forward

steadily as suitable patients presented themselves. Another ballistocardiograph, designed to make records with the subjects standing, has been constructed and placed in operation. A study of the reaction of the heart and circulation to change of position in both normal and abnormal subjects is in progress and abnormalities of a type not detected hitherto have been demonstrated in a number of patients.

Three projects were completed during the year with the assistance of the grant. These have now been published and will be sufficiently defined by their titles:

STARR, I., 1940 (with SCHROEDER, H. A.). Ballistocardiogram. II. Normal Standards, Abnormalities Commonly Found in Diseases of the Heart and Circulation, and their Significance. Jour. Clin. Investig. 19: 437–450.

—— 1940 (with FERGUSON, L. K.). β-Methylcholine Urethane. Its Action in Various Normal and Abnormal Conditions Especially Postoperative Urinary Retention. Amer. Jour. Med. Sci. 200: 372–384.

—— 1940 (with JONAS, L.). Syndrome of Subnormal Circulation in Ambulatory Patients. Arch. Int. Med. 66: 1095–1111.

PAUL R. STEWART and B. K. STEWART, Waynesburg College

Grant No. 350 (1939). Paleontological survey of the 1100 feet above the Monongahela formation in southwestern Pennsylvania.

A continued survey of the region for new fossil horizons has shown that a widespread fossilization of floras occurred at the level of the Waynesburg "B" coal. This level is approximately 120 feet above the base of the series. These beds are often rich in species and the preservation is excellent. Plant-bearing beds are now being found at the base of the Waynesburg coal, once reported a barren area. Nodular-bearing limestone in one such locality carries casts and imprints resembling the Mazon Creek fossils in preservation.

Callipteris conferta has been found decidedly dominant in one area just above the Washington coal. This discovery brings the reported base of the lower Permean in the series to within approximately 200 to 250 feet of the Cassville shale. An earlier record of Fontaine and White corroborates this datum for West Virginia. A new locality extends the level for Sigillaria brardii 400 feet above previous records.

The most interesting zoological fossil comes from the upper Washington limestone. This specimen, as determined by Romer,

"is a deep-bodied palaeoniscid fish, rather like Amblypterus of the Saar Basin." It will probably be the first of its kind to be described in this country. Spines and bifurcate teeth of pleurocanths are not infrequent in near horizons.

Stewart, Paul R., 1940 (with Stewart, B. K.). Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 297–298.

Lester W. Strock, Research Institute of the New York State Saratoga Spa

Grant No. 414 (1940). Geochemistry of natural mineral waters.

The grant is being used to provide technical assistance for continuing the geochemical study of the mineral springs of Saratoga. This work involves a systematic spectrochemical analysis of their trace elements supplemented by similar studies on geological formations of the region and any other rocks and minerals likely to provide evidence of their origin and process of formation. The marked enrichment of zirconium in Saratoga mineral waters, as revealed in spectra of their Cupferron precipitates, has been confirmed. The spectrochemically determined values have been checked gravimetrically by precipitating the zirconium with para-hydroxy-phenylarsonic acid from a solution of the total iron, zirconium and tin coprecipitated directly from the waters by Cupferron. Both tin and beryllium have been determined in the waters and in some geological materials. The elements zirconium (0.35 mg./l.) and tin (0.032 mg./l.) are enriched by a factor of 20 over iron as compared with the average composition of the earth's crust. The titanium and vanadium content of the waters is less than 0.0016 mg./l., if present at all, which represents a decrease in the titanium-zirconium ratio by a factor of at least 4750 compared with the earth's silicate crust. Iron has been separated from the other members of its group—manganese, cobalt and nickel—by a factor 20.

The enrichment of zirconium in the waters has been explained in the following manner. Zirconium is extracted from rocks and minerals by the calcium bicarbonate-rich waters as a soluble salt of the previously unreported compound $Ca[ZrO(CO_3)_2]$. Zirconium is then transported as the dicarbonato zirconyl-ion which is stable in these bicarbonate-rich waters (pH $=5.5$), and apparently even after they have become alkaline (pH $=8.0$) due to the

escaping of all free CO_2 gas. This complex dicarbonato zirconyl-ion is produced by a reaction between calcium bicarbonate and the unstable zirconyl bicarbonate, according to the reaction:

$$Ca(HCO_3)_2 + ZrO(HCO_3)_2 \rightarrow Ca[ZrO(CO_3)_2] + 2H_2CO_3.$$

The close relationship between the complex zirconium compound and dolomite is indicated by its partial deposition in the travertine deposits around the springs. It is more soluble than dolomite, however, as the greater part of the zirconium is still present in the water flowing from the travertine deposits. The corresponding complex titanyl-ion is not stable in these acid waters which is the cause of the complete separation of the titanium from zirconium by them. Some data on Yellowstone Park travertine, and the association of calcite, zircon and titanite from a pegmatite in the Adirondack gneiss, indicates that corresponding complex anions of titanium and zirconium are present and stable in hot alkaline calcium-rich carbonate waters. The formation of the complex zirconyl-ion is due to the strong polarizing effect of the Zr^{+4} ion and its tendency to form the divalent radical $(ZrO)^{+2}$. Two other ions should form similar stable complex ions for the same reason, namely Be^{+2} and $(SnO)^{+2}$.

The following geochemical processes and geological formations are proposed to account for the major constituents and their relative abundance in Saratoga water. They are composed of two distinct facies—a high saline and a non-saline one. The former has a more remote source and is the greater contributor to the total solids present in the water. The latter has a more local source and furnishes a portion of the bicarbonates. The origin of the various solids in the saline facies has been traced to four distinct types of formations which have been leached in the following consecutive order: (*a*) potassium and bromine from the Camillus of the Salina formation of central New York which extends to within fifty miles of Saratoga; (*b*) sodium chloride from the rock salt deposits of the same formation; (*c*) some potassium, sodium, calcium and especially iodine from underlying shales and Trenton limestone through which waters worked eastward into the Little Falls dolomite underlying the Schenectady basin and then northward toward Saratoga, where the dolomite rises to or nearer the surface aided by the north-south fault systems of the region; (*d*) all magnesium and approximately half the calcium from the Little Falls dolomite. This sequence of

formation of the water has been derived by a quantitative consideration of the composition of actual available formations and their known behavior in geochemical processes, and this origin of the waters accounts for the amounts and relative abundance of the commoner solids in the waters. The origin of CO_2 is less certain and is being studied in more detail, but it has most probably entered the water after phase (*b*). Perhaps the CO_2 is derived in part from the carbonaceous matter associated with the Salina and is genetically related to the natural gas deposits of the same region.

Laboratory experiments on the composition of the materials of the geological formations involved in the proposed geochemical genesis of the waters are now in progress, as well as attempts to determine the relative rates of solution of their trace elements by various solutions. Geochemical studies on the halogen content of shales are also in progress; with special reference to the iodine content of carbonaceous shales and fossil marine organisms, and the possibility of using the iodine content as an indication of the presence of early marine life in fossil-barren ancient shales. The possibility of a potassium-rich bittern shale associated with the Salina salt beds as a source of potassium and bromine in Saratoga water is being tested by laboratory experiments on the Camillus magnesia-lime-mud rock.

A summary of all results obtained to date, including the work supported by the grant, was presented at the Philadelphia Meeting of the American Association for the Advancement of Science. The two papers were: (1) "Spectrochemical Determination of Trace Elements in Mineral Waters," on December 28, 1940, to the Chemical Session, and (2) "Some Geochemical Data on Saratoga Mineral Waters" on December 29, 1940, to the Geological Session.

STROCK, LESTER W., 1941. Some Geochemical Data on Saratoga Mineral Waters. (Submitted to the Journal of the Geological Society of America for publication.)

WILLIS L. TRESSLER, University of Buffalo
(Now at University of Maryland)

Grant No. 366 (1939). Seasonal variation of some limnological factors in Irondequoit Bay, New York; specific conductivity of New York and Maryland lakes.

Between August 15, 1939, and June 13, 1940, an investigation was made of Irondequoit Bay, a closed in area at the eastern out-

skirts of Rochester, New York. Series of samples at various depths in the deepest part were taken monthly during this period in order to determine whether the extreme stagnation conditions became modified during the winter, as in most lakes, or whether they persisted throughout the year. It was also attempted to learn if pollution from Irondequoit Creek had any serious consequences in the bay and if there was any noticeable interchange of water from Lake Ontario through the narrow, shallow outlet. Studies were made of the vertical distribution and seasonal variation of temperature, transparency, dissolved oxygen, carbon dioxide, hydrogen ion concentration, alkalinity, soluble and organic phosphorus, specific conductivity, particulate organic matter and macro- and microplankton. In these studies Mr. Thomas S. Austin and Mr. Edward Orban collaborated.

During the summer in the deepest part of the bay (75 feet), no oxygen was present below thirty feet. This condition prevailed until slightly before mid-November when abundant oxygen was present at all depths. By mid-October oxygen had been restored at the fifty foot level but was still absent at the bottom. Circulation of water after the temperature had become uniform from surface to bottom, restored oxygen in the lower areas and dispelled stagnation conditions at a much later date than in Chautauqua Lake, one of the few New York lakes which have been followed throughout the year. Oxygen was restored in Chautauqua Lake by mid-September. After the lake had become closed over with ice in late December, oxygen was gradually reduced at the bottom and had again completely disappeared by mid-March, a somewhat unusual condition in most lakes that have been studied. Winter stagnation in Irondequoit Bay is believed to result from pollution entering by way of Irondequoit Creek and by large quantities of decomposing material on the bottom. The spring mixing of the water restored oxygen at the bottom during April and May but by mid-June it had again become absent in the lower areas. Free carbon dioxide showed much the same trend, indicating periods of stagnation and restoration of circulation. Free carbon dioxide was present in extremely high concentrations at the stagnation periods in early fall and late winter. Other chemical factors corroborated the trends shown by dissolved oxygen. Macroplankton was very abundant during the year except during a short time in January and February when the number of organisms became considerably

reduced but to nowhere near the extent to which they were in Chautauqua Lake during the same period. Microplankton was very abundant during the summer and spring but, as in Chautauqua Lake, it became very scarce during the winter months; during May diatoms became unusually numerous. Particulate organic matter followed the plankton counts very closely, being greatest in amount in the fall and spring and lowest in the winter. Particulate organic matter also showed a decided correlation with transparency, the transparency in general varying inversely as the organic matter.

Specific conductivity is unusually high in Irondequoit Bay (about 600 units), a fact which partly accounts for the high productivity of the lake. Specific conductivity showed a steady rise from October until March, after which time it dropped off steadily. Studies made on several occasions from the headwaters to the mouth of Irondequoit Creek showed that the water entering the bay from this source has a much higher conductivity than the water of the bay; in places up stream the conductivity was about double that found in the open waters of the bay. High conductivity in this case was evidently caused by pollution entering the creek. The water of Lake Ontario has a lower conductivity than that in the bay (about 400 units) and on a day when a very strong wind was blowing directly toward the outlet of the bay from the lake, samples taken at the inlet showed that there was practically no mixture of the lake waters with those of the bay.

In the opinion of some local residents, the poor fishing observed during the last few years and the general stagnant conditions of the bay would be entirely remedied by cutting through a fairly deep channel to the lake, thus allowing free circulation of lake waters into and out of the bay (as in the nearby Sodus Bay). The results of our investigations seem to indicate that stagnation conditions would be greatly improved if such a measure were to be carried out and it is possible that fishing conditions might be improved at the same time. Pollution from Irondequoit Creek does not seem to be severe enough to cause any damage but is probably largely responsible for the high productivity of the bay.

Studies of the specific conductivity of New York lakes, particularly those which have been worked by the State Conservation Department's Biological Survey, have been started and it is hoped that these studies may be completed during the coming summer.

Correlations between specific conductivity and productivity are expected to be made as a result of these investigations. A start has been made in studying the conductivity of such bodies of fresh-water as the State of Maryland and adjoining territory afford.

A summary of seasonal variation of limnological factors in Ironrequoit Bay was given in a fifteen minute illustrated talk before the Limnological Society of America at Philadelphia, December 28, 1940.

The Union Library Catalogue of the Philadelphia Metropolitan Area

Charles W. David, Chairman, Board of Directors

A special grant of \$7,500.00 was approved by Council in December, 1935, for expert work in the production of a Union Catalogue of the Libraries in the Philadelphia Metropolitan Area.

Grant No. 116 (1936) of \$2,500.00 (an equal amount was appropriated by each of the Committees on Publication and Library making a total of \$7,500.00).

Grant No. 177 (1937) of \$6,000.00 for three years.

By far the most important development in the recent history of the Union Library Catalogue has been its removal from the top floor of the Historical Society of Pennsylvania to a more convenient location on the University of Pennsylvania campus and the attempt to build up around it, at least on an experimental basis, a bibliographical center of research. In our report of a year ago we commented on the organization and work of the Bibliographical Planning Committee of Philadelphia, a joint committee of the Union Library Catalogue and of the University of Pennsylvania, which was being financed by the Carnegie Corporation of New York to investigate the whole of the library situation in the Philadelphia area and to formulate plans for the establishment of a community center of research in a proposed new library building at the University of Pennsylvania. Though the report of the Bibliographical Planning Committee is not yet ready for publication and though the University is not yet in a position to erect the proposed new library and to finance a bibliographical center on a long-term basis, it still has been possible to take one very important forward step. With the close cooperation of the Union Library Catalogue and the Bibliographical Planning Committee, the University has been able to obtain a second grant of \$20,000 from the Carnegie Corpo-

ration of New York; and in the early autumn, we proceeded with the establishment of the proposed bibliographical center for an experimental period of sixteen months, September 1, 1940, to December 31, 1941. To accommodate the new enterprise the University has provided suitable quarters on the ground floor of the Fine Arts Building within a few steps of the University Library, and the Union Library Catalogue was moved to this location in the middle of last November.

To operate the new enterprise there was organized in September the Philadelphia Bibliographical Center and Union Library Catalogue under the control of an Executive Board, consisting mainly of the members of the Bibliographical Planning Committee and of the Executive Committee of the Union Library Catalogue. Mr. Rudolf Hirsch, formerly of the New York Public Library, was employed as Director of Operations and Miss Mary Louise Alexander, formerly Director of the Bibliographical Planning Committee, was employed as Director of Planning. Mr. Arthur B. Berthold, Bibliographer of the Union Library Catalogue, was promoted to the rank of Associate Director. Though the Union Library Catalogue has thus entered into a joint arrangement, for a period of sixteen months, whereby it becomes a part of a larger enterprise, it still retains its own identity and independence under its own charter with organization unchanged. Its financial position is secure to the end of 1941, and there is good reason to believe that it will end the year with a comfortable surplus.

During the year 1940 the Union Library Catalogue has continued to make notable progress. Its physical growth has continued at a normal rate, and one new library, that of the Pennsylvania Academy of Fine Arts, has been added to the list of institutions which are now embraced within it; and there appears to be a fair prospect that the Library of the Moore Institute of Art, Science, and Industry will soon also be added. The filing problem, which was serious a year ago, has now been solved. Notwithstanding the fact that since January 1, 1940, we have been subscribing to the full set of Library of Congress proof sheet cards, we believe our files are now as nearly up to date as can reasonably be expected in the operation of such an instrument. There has also been a marked increase in the promptness with which new accessions are reported to the Catalogue. Four libraries are now providing us with temporary records of their new accessions as soon as received and replacing these later with regular catalogue cards; and, thanks to

the efforts of the Director and Staff during the past year to establish contacts with contributing libraries and induce more prompt reporting, a considerable improvement has been noted. The editing of the Catalogue is still in progress, though a little more slowly than in previous years because of the preoccupation of our Bibliographer with other duties. The process of combining cards and removing duplicates from the Catalogue, which it was hoped would be completed through the letter Z before the end of 1940, is unfortunately still unfinished, having only progressed to WAL. However, this work is being resumed and we may look with confidence to its completion in the near future.

No other fact about the Union Library Catalogue is quite so important as the growth of its regular location service and here our latest information is very gratifying indeed. Our staff has prepared a table showing the growth of our service by half-yearly periods since the official opening of the Catalogue in January, 1937. This table is so informing that it is here reproduced as a part of the present report.

It will be seen that during 1940 our location service has doubled, the number of items requested amounting to 21,889. It must be observed, however, that this great increase has been due in considerable measure to the activity of one library, that of the Philadelphia Museum of Art, which has used the Catalogue to check extensive art bibliographies (between 6,000 and 7,000 items) and the figures given in the table may therefore be regarded as to some extent distorted. However, there can be no doubt that our main or location service has continued to make a vigorous healthy growth. Now that the Catalogue has been placed in so convenient a location where it may easily be consulted personally, as well as by telephone or post, there is every reason to anticipate that its use will continue to increase.

During the past year we have been fortunate in receiving considerable assistance which has cost us nothing. A part of this has come through NYA workers who have been supplied us through the cooperation of the University of Pennsylvania and Temple University and who have been used primarily in sorting, alphabetizing, and filing cards. Still other assistance has come indirectly through the Recataloguing Project of the Library Company of Philadelphia, to which allusion was made last year. Unfortunately, this work was suspended for several months during the spring and summer, but it was resumed in August and is now

SUMMARY OF SERVICE STATISTICS BY HALF YEARLY PERIODS: 1937–40

	1937		1938		1939		1940	
	Jan.–June	July–Dec.	Jan.–June	July–Dec.	Jan.–June	July–Dec.	Jan.–June	July–Dec.*
A. Principal Location Service 1. Inquiries by *a.* Telephone	238	395	885	960	1,404	Detailed records not kept for this period.	1,904	1,595
b. Mail	84	94	164	111	125		199	241
c. Personal visit	107	132	171	144	151		293	304
Total	429	621	1,221	1,215	1,680		2,396	2,140
2. Items searched	1,316	1,893	3,060	6,407	5,096		9,293	10,126
3. Items located	794	1,091	1,970	3,679	3,364		5,229	7,134
B. Service to Other Union Catalogues 1. Inquiries	27	27	26	24	40		86	106
2. Items searched	677	443	540	744	538		913	1,143
3. Items located	30	33	44	55	70		205	131
GRAND TOTAL								
1. Inquiries	456	648	1,247	1,239	1,720		2,482	2,246
2. Items searched	1,993	2,336	3,600	7,151	5,628		10,620	11,269
3. Items located	824	1,124	2,014	3,734	3,434		5,434	7,265

* Incl. period with curtailed service during move (ca. Oct. 25–Nov. 25).

making good progress. It is expected that it will be finished in March, 1941. Finally, we have had the good fortune to obtain government approval for a small new WPA project of our own which began operations last October. For the present this provides us with ten WPA workers and a supervisor. The project is designed primarily for the compilation of a partial classified subject index out of about one million duplicate cards which have been removed from the Catalogue in the process of combining identical entries. It is not improbable that the by-products of this undertaking will be of almost as much value to us as the main project itself. During the short period in which the project has been under way much preliminary work of real value has been accomplished and our workers are becoming more competent through experience, though it is as yet too early to speak with confidence about the ultimate results that are to be anticipated.

BERTHOLD, ARTHUR B., 1940. Russkie kollektivnye zagolovkie: Russian corporate headings; a list of over one thousand Russian headings for official and semi-official bodies, based chiefly on the holdings of the Union Library Catalogue, with an attempt at their identification for cataloguing purposes. (Reprint of 1939 edition.)

DAVID, CHARLES W., 1938–40. Reports of Progress. Yr. Bk. Amer. Philos. Soc. for 1937: 216–218; for 1938: 232–235; for 1939: 300–303.

UNION LIBRARY CATALOGUE, 1939– . Bulletin. A news bulletin published at irregular intervals mainly for information to the library profession. Five issues have appeared, four in 1940.

—— 1940– . Check List of Desiderata. A quarterly list of titles which have been asked for at the Union Library Catalogue for which no location is recorded in our file. Three issues appeared in 1940.

DAVID, CHARLES W., 1941 (with BERTHOLD, ARTHUR B., and LINDEROTH, RUTH W.). The Union Library Catalogue of the Philadelphia Metropolitan Area: a Report to the Bibliographical Planning Committee of Philadelphia, July 1, 1940. (To be published in the final report of the Bibliographical Planning Committee of Philadelphia.)

PETER VAN DE KAMP, Sproul Observatory, Swarthmore College

Grant No. 441 (1940). Measurements of double stars on photographs taken with the twenty-four inch Sproul refractor, using coarse objective gratings for the compensation of magnitude equation; the derivation of double star orbits with special attention to these measurements. (This work is in charge of Dr. K. Aa. Strand, research associate at the Sproul Observatory.)

During the past four months (September to December, 1940) 60 plates were measured with a total number of 35,000 single settings at the measuring machine. Miss Virginia Burger made

almost half of these measurements and took care of the reduction of all measures. In addition, she has been engaged in preparatory work for the orbit computation of the well known binary 61 Cygni. A valuable addition to the observational material for this star has been obtained by remeasuring 19 plates taken by Rutherfurd in the years 1871–1874, kindly loaned to the Sproul Observatory through the kindness of Dr. Jan Schilt, Director of the Rutherfurd Observatory of Columbia University.

Miss Janet M. DeVilbiss has carried out the computations for the study of the orbital motion in the visual binary ζ Aquarii; she has also measured the plates obtained for this star. This investigation led to the discovery of an invisible component in the system. The photographic observations played a prominent part in this discovery, which is the third case of its kind in the history of astrometric astronomy. The discovery was announced at the meeting of the American Philosophical Society on November 22, 1940. It is planned to publish the completed investigation in the *Astronomical Journal.*

EDITH VON PORADA, Pierpont Morgan Library

Grant No. 392 (1939). Publication of 450 interesting cylinder seals in the Pierpont Morgan Library.

From April 1940 to December 1940, 476 cylinder seals in the collection of the Pierpont Morgan Library have been photographed, classified and described. Their distribution according to period is the following:

No.	1– 5	Transitional period from Uruk to Jemdet Nasr.
"	6– 27	Jemdet Nasr period. Fully developed style.
"	28	Early Dynastic period I.
"	29– 44	Early Dynastic period II.
"	45– 90	Early Dynastic period III.
"	91–185	Sargonid period.
"	186–188	Post-Sargonid period.
"	189–212	Third Dynasty of Ur period.
"	213–400	First Dynasty of Babylon.
"	401–425	Peripheral.
"	426–476	Cappadocian.

(The numbers listed are subject to change before completion of the catalogue.)

The seals treated in this study are either entirely unpublished or published with inadequate drawings in general works on the sub-

ject of cylinder seals. The most interesting piece of this part of the collection is a cylinder seal of the transitional period from Uruk to Jemdet Nasr; it shows the nude hero with one eye in the middle of his forehead, a figure which has often been identified with "Gilgamesh." The cyclopic eye occurs in only two other instances on later works of Mesopotamian art.[1] Since the elements represented on this seal in the Pierpont Morgan Library are pictured on fragments of a stone vase of the Early Dynastic period found in Khafaje,[2] proof is again given of the continuity of motives from the Uruk and Jemdet Nasr to the Early Dynastic period.

Alexander N. Vyssotsky, University of Virginia

Grant No. 465 (1940). Translation of the astronomical references in the old Russian Chronicles (11th to 17th century A.D.).

The references were collected from the Chronicles by D. O. Sviatsky and published by him in 1918 in the original archaic Russian. They refer to solar and lunar eclipses, sunspots, comets and meteors. By far the greatest number of quotations refer to solar eclipses observed in the daytime, and occupy 150 pages of the Sviatsky paper. The remaining 75 pages contain records of the celestial phenomena observed at night.

Up to January 1, 1941 the translation of the quotations on solar eclipses has been finished, but has not been edited. The remaining part of the translation will be finished before April, 1941. It is hoped that the manuscript will be ready for publication before September of this year. The material when published will be of importance in the study of problems connected with astronomical and historical chronology. While the West European Chronicles as well as the Chinese and Japanese sources have been used extensively, the Russian Chronicles have not been accessible to European and American scholars interested in the subject but not familiar with the Russian language.

J. E. Weaver, University of Nebraska

Grants No. 283 (1938) and No. 380 (1939). Adjustments to drought of midwestern grasslands and the methods and rate of re-establishment.

The dry summer of 1940 continued the drought into a seventh year in eastern Nebraska and an eighth year in western Kansas.

[1] Heinrich, E. Illus. London News for Sept. 5, 1936: 388.
[2] Oriental Institute Communications, 19, Fig. 54, 55.

The study of water content of soil and development of vegetation at twelve permanent stations in the prairies of Iowa, Nebraska, and Kansas has been expanded to include plant production, month by month, as well as seasonal productivity. The results show a high correlation between available water content and production of forage.

Changes in true-prairie vegetation from 1936 to 1939 were determined in seventy-five plots in nine widely spaced prairies in southeastern Nebraska and north-central Kansas. The list quadrat method was employed and changes in abundance and relative stability of the more important species were expressed in percentages. Aster multiflorus, Artemisia gnaphalodes, Solidago glaberrima and certain other perennial forbs continued to decrease. By 1939, they were reduced to only 37 per cent of their abundance in 1936. Amorpha canescens and Oxalis stricta were the only important perennial forbs which made a net gain. Perennial grasses increased in abundance by 1939 to more than twice their abundance in 1936. Bouteloua gracilis, B. curtipendula, and Agropyron smithii, all xerophytic species, made gains of 328, 223, and 89 per cent, respectively. Annual plants increased 564 per cent and attained their maximum numbers in 1937 following great destruction of both perennial grasses and forbs in 1936. They decreased 33 per cent from 1937 to 1938 and 63 per cent from 1938 to 1939.

The prairie vegetation of western Kansas has been studied through eight years of continuous drought, 1933 to 1940, inclusive. Water content of soil has been determined weekly during the growing season to a depth of 5 feet, and a record of aerial environmental factors secured. Reactions of the vegetation have been recorded year by year in scores of permanent, widely distributed quadrats, and by extensive field notes.

Annual precipitation during each of the drought years was below the normal 22.9 inches and during four of the seven years nearly 7 inches below. The accumulated deficit was 34.5 inches in 1939.

Ungrazed ranges of the short-grass type (Bouteloua gracilis and Buchloe dactyloides) possessed a basal cover of 80 to 90 per cent in 1932. This decreased slowly to 58 per cent in 1936, and then rapidly the next year. Although fluctuating somewhat, the cover was further reduced to 22 per cent in 1939. Basal cover of moderately grazed short-grass ranges decreased from 50 per cent in 1935

to 5 per cent in 1936. This was followed by a gradual increase to 28 per cent in 1939, after which losses again occurred. Overgrazed short-grass ranges were reduced to a cover of less than half of that under moderate grazing. Blue grama grass was reduced to 2 per cent, buffalo grass to less than 1 per cent, and the total basal cover to about 2.5 per cent when most depleted in 1936.

Vegetation suffered the greatest losses when overgrazing was accompanied by partial burial by dust. An average basal cover of 1 to 2 per cent showed no increase by 1939. This much depleted type of grassland is of very wide distribution and constitutes a large portion of the vegetation near the center of the dust bowl.

Drought, overgrazing, and hordes of grasshoppers have resulted in great reduction of carrying capacity of the range. Where ten to twelve acres were formerly required to sustain one animal unit, thirty to fifty acres are now needed. Several years with normal or above normal precipitation and with the most judicious range management will be required to restore the former cover of grasses.

WEAVER, J. E., 1939. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 303–305.

—— 1940 (with ALBERTSON, F. W.). Deterioration of Grassland from Stability to Denudation with Decrease in Soil Moisture. Bot. Gaz. **101**: 598–624.

—— 1940 (with ALBERTSON, F. W.). Deterioration of Midwestern Ranges. Ecology **21**: 216–236.

—— 1940 (with ROBERTSON, J. H., and FOWLER, R. L.). Changes in True-Prairie Vegetation during Drought as determined by List Quadrats. Ecology **21**: 357–362.

—— 1941 (with ALBERTSON, F. W.). History of the Native Vegetation of Western Kansas during Seven Years of Continuous Drought. (Accepted for publication in Ecological Monographs.)

NEAL A. WEBER, University of North Dakota

Grant No. 415 (1940). (*a*) An ecological study of the ant fauna of the Imatong Mountains, Anglo-Egyptian Sudan, with special reference to altitude and plant zones. (*b*) A comparison of the habits and behavior of Ethiopian and Neotropical ants.

In 1939 the writer made a safari with the Economic Botanist of the Anglo-Egyptian Sudan through the Imatong Mountains, lying across Latitude 4° N., and climbed the highest peak (10,458 feet). These mountains, highest in the Sudan, lie on the Uganda frontier

and were first represented by name on a map in 1929. They have been visited only by a few officials and a brief botanical expedition. In the summer of 1940, through grants from the American Philosophical Society and American Academy of Arts and Sciences, the collections of ants made on this safari were studied at the Museum of Comparative Zoölogy, the American Museum of Natural History and the United States National Museum.

The study of Imatong Mountain ants reveals that these ants constitute a link between the ant faunas of West, East and South Africa. They have, furthermore, connection with the Mediterranean by means of the Nile Valley so that they appear to be at the crossroads of ant migrations in this great continent. Twenty species were hitherto known only from West Africa, four each from South and East Africa, and six were tropicopolitan species.

The study also shows that there is a high degree of endemicity in the ant fauna, perhaps fifty per cent of at least 124 species, subspecies and varieties, and indicates that the mountains have been isolated by dry plains for a long time, faunistically speaking. The endemicity is much higher than in our own Rocky Mountains which are known to be young geologically and repopulated with ants since the comparatively recent Glacial Age.

The study shows further that many of the ants are confined to one of the three altitude and plant zones. Only one species, Dorylus (Anomma) molesta, a fierce driver or army ant, invades all zones and it is not only the dominant ant but one of the dominant animals of the entire mountain massif except the highest peak. This ant and a second species, Myrmicaria congolensis, are the co-dominant ants of the Acacia abyssinica zone (5600–7200 feet, west slopes; 6000-7200 feet, east slopes.) Only a comparatively few ants ascend from the lower montane slopes (to 5600–6000 feet), which are tropical, to the higher and temperate zones (above 5600–6000 feet). In the highest zone (cloud forest-mountain meadow, 7200–10,458 feet) occur, besides the Dorylus, peculiar species of Campanotus, a new subspecies of the thief ant, Solenopsis punctaticeps, and subspecies of the cosmopolitan Monomorium minutum. The only ant occurring on Mt. Kineti peak (10,458 feet) is a new subspecies of Monomorium minutum which exists on this cold, wet and cloud-capped peak by pasturing coccids ("ant-cows") on the roots of grasses.

PAUL WEISS, University of Chicago

Grant No. 323 (1939). The "resonance" principle of neuro-muscular coordination in mammals, studied by nerve crossing and muscle transplantation, using motion pictures and electrical action potentials as indicators.

The studies demonstrating un-alterability of motor coordination following muscle transposition in the hind limb of the rat, reported in the YEAR BOOK of the American Philosophical Society for 1939, have been continued and a full report has been published.

Experiments carried out with the crossing of nerves showed that motor nerves of rats forty days of age or older are irreversibly specialized so that coordination, after nerve crossing, remains reversed without either central or peripheral adjustments. Conflicting results of earlier authors in other mammals can possibly be ascribed to their crossing of mixed motor nerves with ensuing mass contraction of muscles.

Transposition of tendons in the fore limb of the rat has revealed some trace of corrective changes in the coordination pattern, which can possibly be correlated with the greater development of the pyramidal tracts to the fore limb centers. These experiments are still under way and, viewed against the background of unmodifiability of coordination in the hind legs, promise to facilitate a dissociation between innate and acquired components of coordination.

The oscillographic equipment, contributed in part through the grant from the American Philosophical Society, is being used jointly with equipment provided by a grant from the National Foundation for Infantile Paralysis, in a study of adaptive changes of coordination occurring after tendon transposition in human patients. The action of individual test muscles has been recorded prior to and following the operations, and factors limiting, facilitating and inhibiting central re-education are being studied.

SPERRY, R. W., 1940. The Functional Results of Muscle Transposition in the Hind Limb of the Rat. Jour. Comp. Neur. 73: 379–404.

—— 1941. The Effect of Crossing Nerves to Antagonistic Muscles in the Hind Limb of the Rat. Jour. Comp. Neur. (In press.)

WEISS, PAUL, 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 305–306.

EDGAR T. WHERRY, University of Pennsylvania

Grant No. 403 (1940). Preparation of a monograph on the genus Phlox.

A field trip was taken by automobile to the western United States, covering 13,500 miles. The specimens of Phlox preserved in the twenty-five most important herbaria were identified, annotated and recorded. Visits were also made to numerous localities from which notable collections had been made, and field data on the plants obtained. About ten new species or subspecies were discovered, and descriptions of these are being prepared for publication. At the same time, a number of previously proposed but little known species were studied, and while a few were found to be valid, most of them proved to be identical with long known species which the later workers had overlooked. The genus Phlox thus proves to contain about fifty-five species, some with several subspecies, of which fifteen are eastern and forty western.

P. W. WHITING, University of Pennsylvania

Grants No. 11 (1934), No. 48 (1935) and No. 305 (1939). Investigations on genetics and sex determination in the parasitic wasp Habrobracon.

In the YEAR BOOK for 1939 it was stated that the multiple allele theory of sex determination was in agreement with all data previously accumulated. Proof of this theory has now been obtained for four alleles of the series. The gene fused is sex-linked in stock 36, showing about ten per cent crossing over with the sex differentiating factors, *xa*/*xb*. The recessive gene veinless, *vl*, serves to separate the diploid zygous males from their haploid azygous brothers. When a veinless female heterozygous for fused, $\frac{vl\ +\ xa}{vl\ fu\ xb}$, is crossed with a fused male, *fu xb*, the zygous (non-veinless) offspring show sex linkage, while the azygous males (veinless) are fused and non-fused in equal numbers. Thus according to the formulae chosen, among females there are about ninety per cent wild-type, $\frac{vl\ +\ xa}{+\ fu\ xb}$, ten per cent fused (crossovers), $\frac{vl\ fu\ xa}{+\ fu\ xb}$, while among zygous males there are ninety per cent fused, $\frac{vl\ fu\ xb}{+\ fu\ xb}$, ten per cent wild-type (crossovers), $\frac{vl\ +\ xb}{+\ fu\ xb}$.

Fused has been transferred to another stock, no. 11, known to be "unrelated" to stock 36, since all fraternities resulting from crosses were of the "outcross" type. Stock 11 contains the recessive orange eye, *o*, which serves to separate haploid from diploid males. Fused sons of hybrid females, $\frac{+}{vl}\frac{o}{+}\frac{+\ xd}{fu\ xb}$ for example, were crossed with orange stock 11 females, $\frac{o + xc}{o + xd}$. The majority of these matings proved to be "outcross," indicating that the fused male chosen was a straight, *fu xb*, with a sex allele different from those in stock 11. A few fraternities, however, were "close-cross" (containing diploid males), indicating the fused male parent to be a crossover, *fu xd*. Fused descended from these "close-crosses" has thus been transferred to stock 11.

In stock 11, if an orange female heterozygous for fused, $\frac{o + xc}{o\ fu\ xd}$, be crossed with a fused male, *fu xd*, the zygous (non-orange) offspring show sex-linkage, while the azygous (orange) brothers are fused and non-fused in equal numbers. Since the sex-differentiating factors are similarly linked with fused in the two "unrelated" stocks, they must be allelic (or at least closely linked) with each other.

It has further been shown that reciprocal crosses of the two stocks are "outcross" with respect to fused in that sex-linkage is masked by replacement of the diploid males by females. It is thus impossible to distinguish crossovers from straights. For example, the cross of a stock 36 veinless female heterozygous for fused by a stock 11 orange fused male shows no diploid (non-veinless) males, while fused and non-fused females are in approximately equal numbers.

Stock 36 female	Stock 11 male
$\frac{vl + +\ xa}{vl + fu\ xb}$	$+\ o\ fu\ xd$

Zygous offspring, females.

Straights	$\frac{vl}{+}\frac{+}{o}\frac{+\ xa}{fu\ xd}$,	$\frac{vl}{+}\frac{+}{o}\frac{fu\ xb}{fu\ xd}$
Crossovers	$\frac{vl}{+}\frac{+}{o}\frac{+\ xb}{fu\ xd}$,	$\frac{vl}{+}\frac{+}{o}\frac{fu\ xa}{fu\ xd}$

Azygous offspring, males.

Straights	$vl + xa$,	$vl\ fu\ xb$
Crossovers	$vl + xb$,	$vl\ fu\ xa$

WHITING, P. W., 1940. Multiple Alleles in Sex Determination of Habrobracon. Jour. Morph. 66: 323–355.

—— 1940. Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 306–307.

—— 1940. A Single Series vs. Many Pairs of Sex Factors in the Wasp Habrobracon. Science 92: 418.

HAROLD FISHER WILSON, Glassboro New Jersey State Teachers College

Grant No. 397 (1940). A study of the social history of rural southern New Jersey during the 19th Century.

This grant made possible further search for material on conditions of life in South Jersey during the 19th Century, a continuation of a project instituted by the investigator three years ago and modeled in its scope and approach to the writer's doctoral thesis at Harvard, "The Hill Country of Northern New England, 1790–1930" (Columbia University Press, 1936).

As a result of the grant, material was collected from five libraries:

1. At the New Jersey State Historical Society Library in Newark interesting sidelights about South Jersey life were obtained. The writer was privileged to have access to two trunkfuls of the Rev. Allen Brown papers, uncatalogued material whose contents had not been investigated before. They contained, among other things, a manuscript account of missionary work in the 1890's among Russian Jews, refugee immigrants in Atlantic and Cape May Counties, excerpts of which the writer hopes to be able to present to the New Jersey State Historical Society for publication in its *Proceedings*.

2. At the Rutgers University Library, source material was found in the papers, letters, and journals of Professor George H. Cook, the descriptive accounts of whose visits to South Jersey during the 1870's and 1880's furnish further knowledge of conditions in the region. The Library also contained good contemporary discussions of religious revivals in the area during the 19th Century.

3. The State Library in Trenton was visited to check and amplify "leads" gained during the gathering of material there during the previous two summers.

4. Two weeks were spent in the Library of the Camden County Historical Society, Camden. Particularly interesting for a better understanding of conditions in the days of the South Jersey bog iron ore industry was a diary kept in the early 19th century by a bookkeeper at Martha Furnace, Burlington County. The investigator plans to submit excerpts of this to the New Jersey State Historical Society for publication in its *Proceedings*.

Especially valuable, also, in the Camden Society Library were the six scrapbooks of the late Charles Boyer, former President of the Society, containing publications of the 19th Century reminiscences of a number of citizens of Cumberland and Salem Counties.

5. The first two weeks of August were spent in the Vineland Historical Library in Vineland, N. J., where was found, among other material, information on the influx of Italians to South Jersey in the journal of Charles Landis, founder of Vineland, and first-hand accounts of reactions of Jewish immigrants who came to the Vineland area during the last quarter of the 19th Century.

The project aims to gather material for a book on South Jersey life in the 19th Century. The investigator plans to consider such topics as population trends in South Jersey, the Jewish colonies in the area, the implications of the growth of the Negro population, the impact of Italian immigration, the spread of Philadelphia into South Jersey (suburban movement), the development of the recreation industry on "the shore," the growth of transportation facilities, the period of such "manias" as the silk craze in Gloucester and Camden Counties and the "sugar" excitement in Cape May County, and the highlights of life during the days of the glass and bog iron ore industries.

There has been very little published on this topic. Cornelius Weygandt's recent book, "Down Jersey" is a series of descriptive essays on the area and Henry Beck's "Forgotten Town" books offer popularized versions of various legends and stories, but neither author covers the region from the viewpoint of the social historian.

CLARENCE ZENER and ROBERT H. RANDALL, The State College of Washington and the College of the City of New York

Grant No. 220 (1938). To establish experimentally the relation between internal friction and grain size in non-ferrous metals.

In the YEAR BOOK for 1939 experiments were described which demonstrated that intercrystalline thermal currents are the dominant cause of internal friction in metals over a wide range of conditions. These experiments also determined how this internal friction depends upon the frequency of measurement and upon the grain size of the specimens.

These intercrystalline thermal currents are caused by the elastic anisotropy of the individual crystallites. One thus expects a correlation between the internal friction of different metals measured under corresponding conditions, and the elastic anisotropy of their crystals. An experiment was undertaken to test this correlation. The anisotropy factor of aluminum is very small: nearly forty times as small as that of brass. The internal friction of aluminum was found to be of an order of magnitude less than that of alpha-brass under corresponding conditions.

Experiments have been undertaken to study the factors other than intercrystalline thermal currents which contribute to internal friction. It is commonly known that internal friction increases rapidly with rising temperature. It has been assumed that this high temperature internal friction is associated with some sort of creep. It was not, however, known whether this creep occurred along the grain boundaries or inside the individual grains. By making measurements on specimens of different grain size, we found this high temperature internal friction to be directly proportional to the area between grains. It may thus be concluded, at least for the metal examined, zinc, that creep occurs along the grain boundaries.

RANDALL, R. H., 1939 (with ZENER, C., and ROSE, F. C.). Intercrystalline Thermal Currents as a Source of Internal Friction. Phys. Rev. 56: 343.

ZENER, C., 1940 (with RANDALL, R. H.). Report of Progress. Yr. Bk. Amer. Philos. Soc. for 1939: 308–309.

—— 1940 (with RANDALL, R. H.). Variation of Internal Friction with Grain Size. Trans. Amer. Inst. of Mining and Metallurgical Engineers 137: 41.

—— 1940 (with BARNES, A. H.). Internal Friction at High Temperatures. Phys. Rev. 58: 87.

RANDALL, R. H., 1940 (with ZENER, C.). Internal Friction of Aluminum. Phys. Rev. 58: 472.

SUMMARY OF REPORTS

The serial numbers of grants made in successive years and those for which no reports have been furnished for publication in the YEAR BOOKS for 1937, 1938, 1939 or 1940 may be summarized as follows:

Year	Grant Nos.	Reports lacking
1933–34	1–35	None
1935	36–83	No. 78
1936	84–126	No. 108
1937	127–200	Nos. 132, 159, 166, 172
1938	201–289	Nos. 210, 224, 234, 246, 255, 271, 279, 280, 281, 285, 289
1939	290–392	Nos. 292, 295, 300, 316, 330, 339, 353, 357, 358, 359, 361, 368, 370, 374, 375, 386, 389, 391
1940	393–499	47 Reports in this volume

There has not been sufficient time for reports from all of these latest grants but these and some of the earlier ones will probably be represented in future numbers of the YEAR BOOK.

THE JOHNSON FUND

At the end of the year 1939 a balance of $3,270 was available to be carried over and added to the 1940 appropriation from the Eldridge Reeves Johnson Fund which amounted to $13,000. Therefore, a total amount of $16,270 was available for grants from this fund during the year 1940. The following seven grants were awarded amounting to $12,300 leaving a balance of $3,970 to be carried over to 1941:

Academy of Natural Sciences of Philadelphia

Grant No. 21. Emmett Reid Dunn, Haverford College, for assistants, horses and supplies for an expedition to investigate the herpetological fauna of the fog forest on the higher mountains of the Azuero Peninsula, Panama. .... $ 500

Grant No. 22. Francis W. Pennell, Academy of Natural Sciences of Philadelphia, for traveling expenses in connection with the study of the Scrophulariaceae of western temperate North America on a taxonomic, geographic and phylogenetic basis. (Second grant.) 700

Grant No. 23. Academy of Natural Sciences of Philadelphia, Department of Geology and Paleontology, Benjamin F. Howell, *et al.*, for assistance for the study of type and undescribed specimens of fossils in the Academy's collection in preparing a published, annotated and illustrated list of such specimens, including new material not heretofore described or illustrated. (Third grant.) 3,000

University Museum, University of Pennsylvania

Grant No. 24. Samuel Noah Kramer, Oriental Institute of the University of Chicago, for travel and expenses to complete copying Sumerian literary material in the University Museum, University of Pennsylvania, so as to reconstruct and translate the greater part of the Sumerian literary compositions. 1,800

Grant No. 26. Dorothy M. Spencer, University of Pennsylvania, for field work, interpreter and expenses for the investigation of the Mundāris (a Mundā speaking people) at Khunti, Ranchi Division, Bihar, India. 300

Eldridge Reeves Johnson Foundation for Medical Physics, University of Pennsylvania

Grant No. 27. Britton Chance and Leslie A. Chambers, Johnson Foundation for Medical Physics, University of Pennsylvania, for partial cost of an electron microscope to be used for an investigation of biologically significant materials by direct measurement of their dimensions through electron microscopy and the interpretation of their properties as indicated by variations in geometry and density. 5,000

Not connected with preceding institutions

Grant No. 25. *Annual Tables of Constants*, Hugh S. Taylor, American Commissioner, for the collection and critical analysis of data for the *Annual Tables of Constants and Numerical Data*. 1,000

REPORTS FROM RECIPIENTS OF GRANTS FROM THE JOHNSON FUND

Academy of Natural Sciences of Philadelphia
Department of Geology and Paleontology

Grant No. 23 (1940). Study of type and undescribed specimens of fossils in the Academy's collection.

The salaries of Dr. B. F. Howell, Dr. E. H. Colbert, and Miss Virginia W. Tomlin, and a part of the salary of Mr. Robert G. Chaffee were paid from the grant. These five members of the Academy's staff have, with the aid of Miss Anne Harbison, Dr. H. G. Richards, Dr. Erling Dorf, and workers paid from other funds, carried on the following work:

(1) Cleaned, sorted, and rearranged a part of the Academy's large collection of fossil mollusks so that they are more easily available for study and reference.

(2) Continued the cleaning, sorting, and rearranging of the Academy's collection of fossil plants, begun last year.

(3) Continued the preparation of synoptic, stratigraphic, and geographic cross catalogues of the Academy's vertebrate and invertebrate collections.

(4) Continued the preparation of the catalogue of the mammalian type fossils owned by the Academy by the rechecking of the remainder of the collections for previously unrecorded types.

(5) Continued field and laboratory studies on the Cretaceous stratigraphy and paleontology of New Jersey in cooperation with the Geological Survey of New Jersey.

(6) Completed the preparation of a report on the Miocene stratigraphy and paleontology of New Jersey.

(7) Cooperated with scientists who have consulted the Academy's paleontological collections during the year.

(8) Conducted an expedition to collect vertebrate fossils from the Tertiary beds of the western United States.

(9) Carried on field and laboratory studies of Cambrian geology and paleontology in Pennsylvania, New Jersey, and New York.

(10) Prepared new exhibits of fossils for the Academy's museum.

(11) Cooperated with the Faculty of the Department of Earth Sciences of the University of Pennsylvania in preparing plans for the development of that department and in carrying out those plans. Cooperated also with the Faculty of Bryn Mawr College in the teaching of Vertebrate Paleontology.

(12) Continued laboratory studies of North American Pleistocene invertebrate faunas, made in cooperation with numerous field investigators throughout the United States.

(13) Continued the continent-wide study of North American Cambrian formations and faunas which was begun some years ago.

(14) Identified many fossils for students and amateurs, answered many questions from the public, and otherwise carried on the routine duties which fall to the curators of such institutions as the Academy.

Thanks to the cooperation of the American Philosophical Society, the Academy's collections of fossils are now in such order that they can conveniently be used for research and educational purposes. The rearrangement of the Academy's series of fossils from New Jersey has made possible the inauguration of a program of cooperative research with the Geological Survey of New Jersey which will make possible much needed studies of the fossil faunas of that state and will add greatly to our knowledge of the stratigraphy and paleoecology of the middle Atlantic coastal plain of North America.

The generous support which the Society has accorded to the Academy's Department of Geology and Paleontology during the past few years has greatly stimulated and aided the department in its work and has launched it on a new era of activity and usefulness.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA
Emmett Reid Dunn, Haverford College

Grant No. 21 (1940). Herpetological fauna of the fog forest on the higher mountains of the Azuero Peninsula, Panama.

The trip was made via Santiago, Ocu and Las Minas. The town of Las Minas was reached by road on horseback with baggage in oxcarts. We left Las Minas on July 10, and returned to it August 19. The last habitation on the route south was passed on July 12, and returned to on August 16.

Zoological Results

(Except for some birds and mammals collected at a place we passed on July 11, no collections had been made previously in the uplands of the Azuero Peninsula.)

a) Herpetology. Thirty-two species in all were taken: one salamander, twelve frogs, nine lizards, and ten snakes. Of these, three frog species seem undescribed. There are a number of remarkable extensions of range. The fauna shows affinities with that of the completely separate main cordillera, slightly more with that of the western part in Chiriqui than with that of El Valle in Coclé, but elements of both are present.

b) Other groups. All land molluscs and freshwater fish obtainable were collected. Two specimens of Onychophora seem to belong to an undescribed form which breaks down the present criteria for the genera Peripatus and Oroperipatus. A few insects were taken.

Geological and Geographical Results

The boundary (drainage divide) between Veraguas and Los Santos is not a fairly straight north-south ridge, as mapped, but is very irregular. There is no north-south ridge, but a succession of east-west ridges. The drainage basin of the Quebro River is far larger than indicated on any map. This stream is formed by tributaries from both east and west. The tributaries from the west occupy the area marked on existent maps as the headwaters of the three rivers which flow west and enter Montijo Bay north of the mouth of the Quebro.

The igneous ridge supposed to run down the middle of the peninsula from north to south does not exist. The actual east-west ridges are mostly composed of sedimentary rocks, with marked dips and with east-west strike, and are therefore structural ridges.

Publication of Results

A paper on the herpetological results, one on the Onychophora, and one on the geography and geology of the area, are in process of preparation.

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA
Francis W. Pennell

Grant No. 22 (1940). Study of the Scrophulariaceae of western temperate North America.

We left the vicinity of Philadelphia on March 11; our first collections were made in western Texas and southern Arizona. Entering California at Blyth on the last day of March, we were in or near that state until August 27. In California we established two headquarters for the assembling of the specimens collected, one at Pomona College, for the southern, and the other at the University of California, for the northern and middle parts of the state.

As on preceding expeditions, field notes, including descriptions of floral and other evanescent features, were made for each kind of Scrophulariaceae seen. Our field course was planned so as to obtain as many of these plants as possible. In California there are more species of this family than in any similar portion of the western hemisphere, yet nowhere in the state does this seem a preponderant family, and in some sections the group seems scarce. The total of 383 hitherto described kinds is attained by adding together the species of each local area with its special conditions of lowlands and mountains. Over all the western United States the ranges of most plants are restricted to definite areas, each with its own conditions of growth, and nowhere are such areas so limited and so numerous, nowhere is endemism so highly developed, as in California.

During our nearly five months' visit we were traveling almost steadily, trying to reach each area at the time of best bloom for the plants sought. By mid-August my field study in California was practically completed, and I was consulting types of Scrophulariaceae in the herbaria at the University of California, California Academy of Sciences, and Stanford University; later in the month I was also studying those at Pomona College.

This active and extended program of field work yielded about 400 kinds of Scrophulariaceae, a surprisingly high proportion of the total number that occur in California. Such remarkable success was due to an unusually good season for the project; there had been abundant precipitation the previous winter, which, except on the low ranges of the northwest, had persisted into summer as snow on the higher elevations. Until nearly the end of April, showers

were still falling in southern California. After that we had uninterrupted good weather until leaving the state; doubtless, the lack of summer rains made the mountain floras pass more rapidly than in many seasons, but this did not happen until I had gotten most species of this group of plants. About a third of the Scrophulariaceae desired are annual plants that do not even germinate in absence of sufficient moisture; this year such were plentiful everywhere, except on the mountains along the northwestern coast where the water had not been stored as snow.

The collections of plants, nearly all Scrophulariaceae, made on the entire expedition, numbered 1,590, which with duplicates comprise about 8,000 actual specimens. Field descriptions were drawn of some 400 kinds of plants of this family. Among these must be a fair proportion of entities still unknown. Thus, floral characters show that a number of distinct species have been merged together in the supposedly single species of Scrophularia usually attributed to California. But field acquaintance may be equally valuable in deciding problems of relationship among species that have been long known, and the descriptions from this and earlier expeditions are in constant use as my studies advance.

Eldridge Reeves Johnson Foundation for Medical Physics, University of Pennsylvania

Detlev W. Bronk

Grant No. 19 (1939). Neural and chemical factors affecting the excitation of nerve cells at synapses.

There are three aspects of the work carried out during the past year under this grant.

One series of investigations has dealt with the neural factors controlling the excitation of a nerve cell in a sympathetic ganglion. Impulses have been recorded in single postganglionic nerve fibers while stimulating various numbers of preganglionic fibers at determined frequencies. It has thus been possible to see that the frequency under which a nerve cell discharges its impulses can be controlled either by a variation in the frequency of impulses in the presynaptic fibers or by a variation in the number of presynaptic fibers conducting trains of impulses. It has also been found that the effects of a volley of presynaptic impulses may endure many seconds, for the cumulative effect of ten or more volleys arriving

over a period of as many seconds may be necessary to bring certain ganglion cells into action. The influence of calcium and potassium ions on the frequency characteristics of the response to neural excitation has been extensively investigated.

A second group of experiments has been concerned with the synaptic mechanisms involved in the excitation of sympathetic motoneurons by the hypothalamus. Stimulating electrodes were placed within the hypothalamus by means of a Horsley-Clarke stereotaxic instrument, and impulses were recorded in the postganglionic neurons of the cervical sympathetic nerve. Stimulation on either side of the hypothalamus causes sympathetic motoneurons on both sides to discharge rhythmically at frequencies proportional to the intensity and frequency of stimulation. If both sides of the hypothalamus are stimulated simultaneously, the neurons discharge at frequencies which are higher than those observed when either side is stimulated separately. Following a testing period of hypothalamic stimulation the rate of discharge of sympathetic neurons to constant hypothalamic stimulation decreases initially and gradually recovers to the control value. This reduction in the excitability of the neurons to hypothalamic stimulation is proportional to the frequency and intensity of the test stimulation.

Because of the importance of oxidative processes in the excitatory mechanisms of nerve we have developed methods for recording rapidly the oxygen consumption of a group of nerve cells while at the same time measuring the rate of impulse formation in the cells. Among our initial findings of significance is the observation that changes in the chemical environment of nerve cells may produce definite increases in the rate of oxygen consumption before initiation of impulses begins. We may accordingly conclude that a change in the structure of a nerve cell not sufficiently great to cause the development of propagated impulses increases the demand of the cell for oxygen. In general, as the rate of activity of a nerve cell increases as a result of chemical or electrical stimulation, the extra oxygen consumption is increased. In certain cases, however, as for instance the increase in activity induced by increases in the potassium ion concentration, there is a decrease in the rate of oxygen consumption. This indicates that there is no direct parallelism between the rate of nervous activity and the rate of increased oxygen consumption. This is probably due to the fact

that different modes of chemical excitation set into action different sequences of metabolic events.

BRONK, D. W., 1940 (with LARRABEE, M. G.). Neural Factors Determining the Frequency of Impulses Discharged from a Ganglion Cell. Amer. Jour. of Physiol. 129: 320.

—— 1940 (with LARRABEE, M. G., and PITTS, R. F.). The Rôle of the Hypothalamus in Cardiovascular Regulation. Amer. Jour. of Physiol. 129: 441.

UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA

Samuel N. Kramer, Oriental Institute of the University of Chicago

Grant No. 24 (1940). To complete the copying of Sumerian literary material in the Nippur Collection of the University Museum and the reconstruction of the Sumerian literary compositions.

In the course of the past fifty years a number of tablets and fragments inscribed with Sumerian literary material and dating from about 2000 B.C. have been copied and published. Most of them, however, are so badly broken and so poorly preserved that the trustworthy and scientific reconstruction and interpretation of their texts are impossible. The Nippur Collection of the University Museum consisting of fifteen thousand tablets and fragments contains a large number inscribed with this Sumerian literary material. It is my task to uncover and copy the unpublished ones among them and thus make possible the reconstruction of the Sumerian literary compositions and their interpretation.

After examining the entire Nippur Collection of the museum I succeeded in finding and cataloguing 675 unpublished tablets and fragments inscribed with Sumerian literary material. Of this number approximately 175 are epics and myths, 350 are hymns and laments, and 150 are proverbs and "wisdom" literature. Work this year is being concentrated on the epics and myths. The reconstruction in large part of the following epics and myths is now possible:

Epics: 1. *Enmerkar;* tale of the heroic exploits of Enmerkar in the struggle between Erech and Aratta. 2. *Lugalbanda and Enmerkar;* the exploits of Lugalbanda in the service of Enmerkar, king of Erech. 3. *Gilgamesh and Agga;* the struggle between Kish and Erech. 4. *Gilgamesh and Huwawa;* the story of Gilgamesh's determination to enter the mountain of immortality and his vic-

torious struggle with the monster Huwawa. 5. *Gilgamesh, Enkidu and the Nether World;* Gilgamesh learns of secrets of the nether world through his servant Enkidu. 6. *The Exploits of Ninurta;* he vanquishes the monsters of "kur," builds the "hursag," decrees the fate of the stones. 7. *The Return of Ninurta;* his reception in Nippur and the exaltation of his temple. 8. *Inanna and Entiki;* story of the struggle of the goddess with the monster(?) Entiki. 9. *Inanna's Descent to the Nether World.*

Myths: 1. *Enki and Ninhursag;* a Dilmun vegetation myth of utmost importance. 2. *Enlil and Ninlil;* a Nippur vegetation myth. 3. *Emesh and Enten;* an agriculture myth. 4. *Ganam and Ashnan;* the introduction of agriculture and animal domestication in Sumer. 5. *Enki and Ninmah;* the creation of man. 6. *Enki and Sumer;* introduction of civilization in Sumer. 7. *Enki and Eridu;* building of Enki's temple in Eridu and Enlil's blessing. 8. *The Creation of the Pick;* an agriculture myth. 9. *The Pick and the Plow;* another agriculture myth. 10. *Inanna and the Transfer of Civilization from Eridu to Erech.* 11. *The Journey of Sin to Nippur.* 12. *The Deluge.*

Annual Tables of Physical Constants and Numerical Data

Hugh S. Taylor, American Commissioner

Grant No. 25 (1940). Collection of data for the publication of *Annual Tables.*

The headquarters of the international Commission on Annual Tables and the editorial staff conducting this work were, until June 1940, located in Paris. As a result of the German invasion the entire work of the office was disrupted and the editor of the *Annual Tables* was forced to withdraw from Paris to the University of Montpellier in the unoccupied part of France. At the urgent request of the Swiss Commissioner, Professor Paul Dutoit, of the University of Lausanne, efforts were initiated by the American Commissioner to have the work of *Annual Tables* transferred temporarily to this country since it was impossible to conduct the work of the Commission in orderly fashion in France at the present time. Permission to secure the transfer of this work has occupied a considerable amount of time but, with final action by the Secretary of State, permission has been secured and suitable visas for

the editor and his wife have now been forwarded to Marseilles. It is hoped, therefore, that within the next month the editor of *Annual Tables* and his collaborator will be in this country when the work of the Commission, at present supported in part by the Johnson Fund of the American Philosophical Society, should go forward. It is to be regretted that by reason of international conditions it has not been possible to make a more positive report concerning the achievements under this grant. It is expected, however, that in the coming year a large measure of achievement will be indicated.

THE DALAND FUND

During 1940 $7,000 was available for grants from the Judson Daland Foundation for Research in Clinical Medicine. There was no balance carried over from 1939. With the approval of Drs. Alfred N. Richards and Edwin G. Conklin, who had been appointed a sub-committee of the Committee on Research to consider and report upon applications for grants from the Daland Fund, $6,000 was awarded to the Philadelphia Institute for Medical Research, leaving a balance of $1,000 to be carried over to 1941. The following is a report on the work accomplished under the grant awarded to the Philadelphia Institute for Medical Research.

Philadelphia Institute for Medical Research

Grant No. 3 (1940). Investigations on the rôle of the thymus and pineal glands in growth and development, and other clinical problems.

By the aid of this fund we have been enabled to continue our laboratory and clinical studies in various fields.

(1) Laboratory Investigations.
- (*a*) On the thymus gland.
- (*b*) On the production of tumors with crude wheat germ oil made by extraction with ether.
- (*c*) On the bacteriocidal effects of capric acid derivatives (tri-caprin, cadmium alpha mercaptocaprate), and of goat's milk (rich in capric acid) on the growth of the bacillus of tuberculosis *in vitro* and on the course of experimental tuberculosis in guinea pigs.
- (*d*) The development of nervous manifestations (incoördination, spasticity and ataxia) in young rats, following destructive doses of X-ray irradiation to their thymus glands.

(2) Clinical Studies.
- (*a*) Thymus extract has been given an extensive therapeutic trial in a number of diseases over a period of five years:

	Cases
Congenital mental retardation	25
Mongolian idiocy	16
Dementia praecox	7
Cerebral spasticity	4
Cerebral aplasia	3
Involutionary melancholia	2
Myasthenia gravis	8
Osteogenesis imperfecta	6
Chronic eczema	20
Chronic arthritis	12
Paget's disease	18

Only in one disease has thymus extract proved of any great therapeutic value, that is in osteitis deformans, or Paget's disease. In this disease it brings about most striking symptomatic relief at times. However, its effect is not curative. It decreases or relieves the suffering in Paget's disease, which otherwise is notoriously resistant to all forms of treatment. A general article on the thymus gland was published in the Cyclopaedia of Medicine.

ROWNTREE, L. G. 1940. The Thymus Gland in Health and Disease. The Cyclopaedia of Medicine (Piersol), F .A. Davis Company, Philadelphia, Pa.

(*b*) Three cases of osteochondrodystrophia deformans, or Morquio's disease, have been carefully investigated and reported, with some pertinent suggestions relative to the pathogenesis of the nervous manifestations which develop in this affliction.

—— 1941 (with MOORE, J. R., and EINHORN, N. H.). Morquio's Disease. Jour. Diseases of Children. (In press.)

(*c*) Studies of a group of cases suffering from anomalies of growth and development, such as juvenile myxedema, cryptorchidism, Frölich's disease, and hypogonadism, and the effects in these diseases of various forms of therapy.

—— 1940. Thyroid Therapy in Juvenile Myxedema. Jour. of Diseases of Children 16, 6: 770.

—— 1941 (with EINHORN, N. H.). The Control of Gonadal Development. Penna. Med. Jour. (In press.)

(*d*) Further studies on Addison's disease, dealing with increasing survival time and with the results of various forms of treatment.

—— 1940. Diseases of the Suprarenal Glands. Cecil's Text Book of Medicine, Fifth Edition, W. B. Saunders and Company, Philadelphia, Pa., 1940.

—— 1940. Report of Three Cases of "Clinical" Addison's Disease Surviving More Than Fifteen Years. Endocrinology 26, 5: 793–800.

—— 1940. An Improving Prognosis in Addison's Disease. Assoc. of Amer. Physicians 4: 175–178.

—— 1940. Increasing Survival Time in Addison's Disease. Results in Six Cases With a Non-commercial Product of the Adrenal Cortex and a High Salt Intake. Jour. Amer. Med. Assoc. 114: 2526–2530.

—— 1940. The Results of Various Forms of Treatment in a Case of Addison's Disease. Clinics of North America (Philadelphia Number), November. W. B. Saunders and Company, Phila., Pa.

(*e*) A Report of 1000 Cases of Pneumonia in Children Treated by Non-Specific Forms of Therapy. This furnishes a yard stick for determining the value of the newer forms of management with chemotherapeutic agents of the sulfanilimide group.

Holmes, John W., 1941 (with Jones, Harold W., and Einhorn, N. H.) (of the Philadelphia Institute for Medical Research). A Report of 1000 Cases of Pneumonia in Children Treated by Non-Specific Forms of Therapy. Penna. Med. Jour. (In press.)

(*f*) Studies in the field of hypertension—the effects of sympathetic ganglionectomy—the effects of renal ischaemia—of irradiation simultaneously administered to the adrenal and pituitary glands, and the carotid sinuses—the effects of intravenous administration of renin. Finally, the rôle of the kidney in cardiorenal-vascular disease.

Rowntree, L. G., 1940. The Rôle of the Kidney in Cardiovascular-renal Disease. Illinois Med. Jour. 78: 109.

—— 1940. Hypertension and Unilateral Disease of the Kidney. Urologic and Cutaneous Rev. 44, 1: 24–25.

(*g*) "Aviation Medicine," a report of what the physician should know about this subject; given as part of the medical program on "Preparedness."

—— 1940. Aviation Medicine. The Weekly Roster and Medical Digest 36, 12: 364.
—— 1941. Hyperinsulinism. Jour. N. J. State Med. Soc. (In press.)
—— 1941. The Therapeutic Use of Hormones and Endocrine Products. (Presented by invitation at the United States Pharmacopoeial Preconvention Conference of the U. S. P. Hormone Advisory Board, Washington, D. C., May 1940.) (In press.)

Finally, it might be stated that the Director of the Philadelphia Institute for Medical Research, at the request of the London Association for War Research, participated this summer in the organization and development of a group for research in aviation medicine. This unit has now been taken over by the Medical Division of the Royal Canadian Air Force.

6. REPORT OF THE COMMITTEE ON FINANCE

According to the Laws of the Society, the Committee on Finance consists of the President and the Treasurer, *ex-officio*, and not fewer than five other members who shall be nominated by the President and elected by the Society at the General Meeting in April.

Chapter V, Articles 3 and 4 of the Laws read:

"The Committee on Finance shall have the general superintendence of the financial concerns of the Society. It shall have the custody and control of all the securities and investments of the Society, both real and personal, with full power and authority to buy and to sell, and to invest and reinvest the same; including the power to purchase and to sell real estate and to make leases thereof, to satisfy mortgages and extinguish ground rents, and to direct the placing of all such insurances as it may deem necessary; as well as to borrow on the credit of the assets of the Society, to create mortgages thereon, and to make such improvements, repairs and alterations to real estate as it may deem necessary. It shall have power to authorize the proper Officers of the Society to execute the necessary papers to effect all purchases, sales and assignments of property, both real and personal; to execute and to satisfy mortgages, to extinguish ground rents and to transfer registered securities; to subscribe to bond-holders' agreements to plans of reorganization involving any securities held by the Society or in which it has an interest, and to do all such acts as are necessary in pursuance of the foregoing powers.

"The Committee on Finance shall always have access to the Treasurer's books, accounts, and vouchers, and shall cause an audit of such accounts to be made at least once a year. It shall require from the Treasurer an annual report of all the operations of the treasury, which it shall present to the Council with an annual statement of estimates of receipts and expenditures. With the approval of the Council it shall determine the fiscal year of the Society and, in case of emergency needs, authorize appropriations over and above the annual budget."

During the year 1940–41, the Committee on Finance consisted of Marshall S. Morgan, *Chairman*, Thomas S. Gates, Edward Hopkinson, Jr., John Story Jenks, Charles J. Rhoads, J. Henry

Scattergood and Roland S. Morris, *President*. Edwin G. Conklin, *Executive Officer*, and Morris Duane, *Legal Consultant*, sat with the Committee.

The members of the Committee meet regularly once a month from January to June and from October to December with occasional special meetings.

REPORT OF THE TREASURER

General and Special Funds

There are twenty-two funds in the keeping of the Society. Only four of these are unrestricted in the uses to which their income may be applied "for promoting useful knowledge;" three specify a primary purpose, after which any balance may be used for general purposes; fifteen are restricted to specific uses, eleven of these being for the purchase of books for the Library. These funds and the manner and purpose of their establishment are listed alphabetically below.

Associated Fund

Created as of December 31, 1939, in accordance with a resolution adopted by the Committee on Finance, December 5, 1939, with the approval of Legal Counsel. All assets held in the Balch International Law Library, Boyé Library, Brush Endowment, Carlier Library, Franklin Library, Jefferson Library, Lewis, Magellanic, Michaux, Norris Library, Phillips Library, Proud Library, Seybert Library and Tilghman Library Funds, were transferred to the Associated Fund at their market value as of December 31, 1939, and each contributing fund was assigned a proportionate interest in the Associated Fund based on the value of assets contributed.

Balch International Law Library Fund

Founded by Thomas Willing Balch, Esq., of Philadelphia, October 13, 1911, with an initial gift of securities valued at about $700, increased by later gifts to about $1,600, as a memorial to his father for his part in bringing about the submission of the Alabama Claims to the Geneva Tribunal. A part of the income to be used for the purchase of books relating to the law of nations and such other uses, when thought advisable, as may promote

the study of that science; a part, not less than one-half, to be added annually to the principal.

BOYÉ LIBRARY FUND

Bequest of $1,879.21 by Professor Martin Boyé, of Coopersburg, Pa., who died March 5, 1909. By resolution of the Society, December, 1910, the income to be expended in the purchase of books, preferably on chemistry and geology.

BRUSH ENDOWMENT FUND

Gift of $10,000 by Charles Francis Brush, LL.D., of Cleveland, Ohio, November 24, 1914. Income to be used for the general purposes of the Society.

BUILDING FUND

Created by deed of trust dated June 4, 1900, Girard Trust Company, depositary and trustee. All money or property which shall be designated or devoted by any donor, testator or other person, for the acquisition of land or buildings for the Society's use, shall be forthwith paid over, conveyed, or delivered by the Society to the said depositary, for the acquisition of land and the construction and furnishing of buildings for the use and occupation of the Society. The present value is $625,527.40.

CARLIER LIBRARY FUND

Bequest of $5,000 by Auguste Carlier, of Paris, who died March 16, 1890. The income, less 10 per cent which is to be added to the principal, is to be expended for the purchase of books for the Library.

CARNEGIE LIBRARY FUND

Gift of $100,000 by the Carnegie Corporation in 1931. The income to be used for the maintenance of the Library.

DALAND FUND

Bequest of the residuary estate of Dr. Judson Daland, of Philadelphia, who died August 14, 1937, approximately $220,000. The income, less 10 per cent which is to be added annually to the principal, to be used by the Society for research in clinical medicine.

Franklin Library Fund

Established by the Library Committee in May, 1911, from funds derived from the proceeds of the sale in that year of duplicates, formerly the property of Benjamin Franklin, approximately $3,400. The income to be used for the purchase of books.

General Fund

This fund has been accumulated from various sources through many years; its income is available for the general purposes of the Society.

Jefferson Library Fund

Established by the Library Committee on January 20, 1905, from the proceeds of royalties from the publication of manuscripts acquired by the Society through President Thomas Jefferson, approximately $1,700. Income to be used for the purchase of books.

Johnson Fund

Established in 1937 when Mr. Eldridge Reeves Johnson removed the restriction on his gift of $500,000 and changed it to General Endowment until 1957, unless prior thereto Mr. Johnson directs that it be used for some other purpose of the Society. After 1957 it is to become an unrestricted gift. All income to be used for the general purposes of the Society.

Lewis Fund

Gift of $10,000 made by Mrs. John F. Lewis in 1935 in memory of her husband; the income to be used each year as an award to the American citizen who shall announce at any general or special meeting of the Society, and publish among its papers, some truth which the Council of the Society shall deem worthy of the award. In any year income not so awarded to be added to principal.

Magellanic Fund

Gift of 200 guineas by John Hyacinth de Magellan, of London, in 1786, for a gold medal to be annually awarded under prescribed terms, to the author of the best discovery or most useful invention relating to navigation, astronomy, or natural philosophy (mere natural history only excepted). Any surplus of interest remaining to be used for such purposes as may be authorized

under the Society's Charter and Laws. By resolution of the Society, December, 1899, the unexpended annual income, less 10 per cent which is to be added to the principal, may be used for the purchase of books relating to those departments of science in which the premium is annually offered.

MICHAUX FUND

Bequest of 92,600 francs by François André Michaux, who died at Vaureal, France, October 23, 1855; for the extension and progress of agriculture, and more especially of sylviculture, in the United States. By resolution of the Society, March, 1899, the income, less 10 per cent reserved for reinvestment, to be used for the purchase of books on forestry, etc.

NORRIS LIBRARY FUND

Established by the Library Committee in May, 1911, from the proceeds of the sale in that year of duplicate pamphlets, presented to the Society in 1815 by Joseph Parker Norris, Esq., of Philadelphia, approximately $2,100. Income to be used for the purchase of books.

PHILLIPS LIBRARY FUND

Bequest of his residuary estate, approximately $3,410 (December, 1895), by Henry Phillips, Jr., Esq., of Philadelphia, who died June 6, 1895, to which were later added two bequests to him, confirmed and audited October 5, 1903, of $7,547.54 from the estate of his aunt, Emily Phillips, and of $42,315.80, being an interest in the residuary estate of his uncle, Henry M. Phillips. Income to be used for the purchase of books on archaeology and philology in accordance with the terms of the bequest.

PHILLIPS PRIZE ESSAY FUND

The gift on October 5, 1888, of $5,000 by Miss Emily Phillips, of Philadelphia, in memory of her brother Henry M. Phillips. Income to be used in the awarding of a prize for the best essay of real merit on the science and philosophy of jurisprudence.

PENROSE FUND

Bequest of one-half of the residuary estate of Dr. Richard A. F. Penrose, Jr., of Philadelphia, who died July 31, 1931, approximately $3,900,000; by the terms of the bequest this gift to be considered an endowment fund, the income of which only is to be used and the capital to be properly invested.

Proud Library Fund

Established by the Library Committee in May, 1911, from the proceeds of the sale in that year of duplicate pamphlets presented in 1812 by Robert Proud, Esq., of Philadelphia, $2,500. Income to be used for the purchase of books.

Seybert Library Fund

Bequest of $2,000 by Henry Seybert, Esq., of Philadelphia, who died March 3, 1883. By resolution of the Society, November, 1909, the income to be expended for the purchase of books.

Tilghman Library Fund

Bequest of $200 by Chief Justice William Tilghman, of Philadelphia, who died April 30, 1827. Income to be expended for the purchase of books.

Wood Memorial Fund

Bequest of the residuary estate of Walter Wood, of Philadelphia, who died April 20, 1934, approximately $150,000, in memory of his uncle, George B. Wood, his cousin, Horatio G. Wood, and his two brothers, Richard and Stuart Wood, all of whom were members of the American Philosophical Society; to be used by the Society first for the construction of a building that shall be adequate for the needs of the Society and if there be any surplus, then the same to be applied to such useful purpose or purposes as the Counsel (sic) and Officers of said Society may determine.

Budget for 1941

Estimated Income

Unrestricted Funds		
General Fund	$ 31,476.00	
Charles Francis Brush Endowment	463.77	
The Johnson Fund	15,936.50	
Richard A. F. Penrose, Jr., Endowment	141,278.20	
		$189,154.47
Semi-Restricted Funds		
Magellanic Fund	$ 227.97	
François André Michaux	2,128.22	
Wood Memorial Fund	5,427.25	
		$ 7,783.44
Restricted Funds		
A. *Library Funds*		
Thomas Balch International Law	$ 183.15	
Martin Boyé	137.79	
Auguste Carlier	572.76	
Carnegie Library	4,000.00	
Benjamin Franklin	406.26	
Thomas Jefferson	153.00	
Joseph Parker Norris	190.44	
Henry Phillips, Jr.	3,537.10	
Robert Proud	233.28	
Henry Seybert	156.37	
William Tilghman	83.20	
		$ 9,653.35
B. *Special Funds*[1]		
Judson Daland	$ 9,872.00	
John F. Lewis Prize	415.89	
Henry M. Phillips Prize Essay	472.75	
		$ 10,760.64
Sales of Publications		$ 2,500.00
		$219,851.90

[1] See Schedule VIII for Building Fund.

Estimated Expenses

Executive Office	$ 10,500.00	
Secretaries' Expense	2,500.00	
Telephone	450.00	
Insurance	2,000.00	
Committee on Publications	25,000.00	
Committee on Library:		
Books and Binding	7,000.00	
Librarians' Salaries	10,420.00	
Rental for Housing of Library	8,700.00	
Treasurer's Expense and Compensation	7,000.00	
Hall Fund	2,500.00	
Committee on Research:		
Penrose Fund	75,000.00	
Johnson Fund	13,000.00	
Daland Fund	7,000.00	
Research Expense (Penrose Fund)	500.00	
Meetings	7,000.00	
Miscellaneous	10,000.00	
		$ 188,570.00

Balances carried forward from 1940 to pay appropriations made under the 1940 Budget		
Books and Binding	$ 5,324.60	
Publication Expenses	20,255.90	
Research Fund (Penrose Fund)	35,682.33	
Research Fund (Johnson Fund)	9,753.34	
Research Fund (Daland Fund)	1,000.00	
		$ 72,016.17

The total book value of the investments and cash held as Principal as shown by the Accountants' report is:

Unrestricted Funds	$5,558,810.63	
Semi-Restricted Funds	672,905.02	
Restricted Funds	495,150.18	
Building Fund	615,197.42	
		$7,342,063.25

Respectfully submitted,
Fidelity-Philadelphia Trust Company,
Treasurer,
Marshall S. Morgan, *President*.

REPORT OF THE CERTIFIED PUBLIC ACCOUNTANTS

LINVILL & PARRY

Certified Public Accountants

Twelve South Twelfth Street, Philadelphia

February 17, 1941

ROLAND S. MORRIS, ESQ., *President*,
The American Philosophical Society,
Philadelphia, Pa.

Dear Sir:

GENERAL AND TRUST FUNDS

We have examined the accounts of the American Philosophical Society for the year ended December 31, 1940, as contained in the records of the Treasurer, the Fidelity-Philadelphia Trust Company. The appended statements, Schedules I to VII inclusive, are in accordance with these records.

We have examined paid cancelled checks and vouchers in connection with disbursements in the various funds except the Wood Fund Real Estate Income Account, as to which we have accepted the cash records of the Fidelity-Philadelphia Trust Company as agent, without any further examination. The cash in bank at December 31, 1940, as summarized in Schedule VI, has been verified.

We have examined into the changes during the year in the investments in all of the funds. We examined the perpetual and other fire insurance policies carried as an investment in the General Fund, and obtained detailed statements from the Fidelity-Philadelphia Trust Company, the Girard Trust Company, and The Pennsylvania Company, etc., showing at December 31, 1940, the bonds, stocks, real estate and other investments held by them as agents or trustees for the Society, thus satisfactorily accounting for all of the investments of the Society as called for by the records at December 31, 1940.

The investments composing the various funds at December 31, 1940, as summarized in the appended statement (Schedule VII) are at book value, which, in all funds except the Associated Fund, is as follows: Bonds and Mortgages at par or face value to January 1, 1940, and at par or cost, whichever is lower, for subsequent purchases; Stocks at cost when purchased or at inventory value when

received as gifts or bequests; and Real Estate at amount of foreclosed mortgage plus costs of acquisition and subsequent improvements, and appraised or assessed value when acquired as gifts or devises. The Associated Fund investments are at cost. We have not determined the current market value of any of the investments of the Society.

Income due for the year from the investments has been received and recorded on the books prior to December 31, except as follows:

General and Other Trust Funds:	
Bond Interest in Default	$1,692.00
(Including $1,322.00 in default January 1, 1940)	
Carnegie Library Fund:	
Delinquent Mortgage Interest	1,308.06
(Including $575.00 in default January 1, 1940)	
	$3,000.06

We do not list as in arrears, deferred interest originally due November 1, 1938, and subsequent interest periods, from issues of the Lehigh Valley Railroad Company, which issues are subject to extension plan and agreement, dated August 25, 1938, under which 75 per cent of the interest has been deferred and only 25 per cent paid.

Comprehensive tests have been made of the income receivable from other sources, except as to real estate, for which we have not examined leases, rental statements or other data in connection with income recorded as being received.

Building Fund

Girard Trust Company, Trustee

We have examined statements submitted by the Girard Trust Company, Trustee, of the Building Fund for the year ended December 31, 1940, have examined the records in the Society's office of subscriptions or pledges to the fund, and have prepared the appended statement of Cash Receipts and Disbursements and Summary of the Assets for the year—Schedules VIII and IX.

The cash and investments are in accordance with a statement obtained by us from the Girard Trust Company, Trustee, setting forth in detail the assets in their possession at December 31, 1940. All of the investments are at par value except stocks, which are at

cost, with real estate (participations) at amount of foreclosed mortgage plus costs of acquisition and subsequent improvements. We have not determined the present value of any of the investments, or the collectibility of the unpaid pledges to the fund.

We have examined into the changes during the year in the investments, and have accounted for all income due except delinquent mortgage interest $5,036.67, of which amount $1,893.97 was delinquent January 1, 1940. As explained under General and Trust Funds, we do not list as in arrears interest deferred on bonds of Lehigh Valley Railroad Company.

Respectfully submitted,

LINVILL & PARRY,

Certified Public Accountants.

SCHEDULE I

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1940

GENERAL FUND

Principal Account

Balance, January 1, 1940			$ 728.38
Receipts:			
Investments Sold or Redeemed:			
Public Utility Bonds		$ 826.39	
Common Stocks		90.99	
On Account of Mortgages		550.00	
Fine Arts All Risks Insurance (1 year's charge)		1,205.32	
Walter Wood Real Estate Principal Account:			
Payment on account of advances by General Fund		32,500.00	
			35,172.70
			$ 35,901.08
Disbursements:			
Investments Purchased:			
Railroad Bonds ($17,000)		$ 18,190.00	
Common Stocks		9,210.81	
Fine Arts All Risks Insurance (5 yr. policy)		6,026.52	
			33,427.33
Balance, December 31, 1940			$ 2,473.75

Income and Operating Account

Balance, January 1, 1940			$ 1,221.11
Receipts:			
Income from Investments		$ 33,555.57	
Girard Trust Company Building Fund Reimbursement for alterations and furnishing of Society's building, etc.		1,826.01	
Sale of Publications		3,026.62	
Royalties on W. B. Scott's book, "History of Land Mammals in the Western Hemisphere"		352.07	
The Henry LaBarre Jayne Lecture Foundation		200.00	
Sale of Microfilms		201.01	
Refunds—Penrose Research Fund Grants		300.02	
Special Deposit, Penna. Co. (1931) and interest not previously recorded		101.13	
Transfer of Income from Trust Funds:			
Richard A. F. Penrose, Jr., Endowment Fund	$143,392.72		
The Johnson Fund	13,000.00		
Judson Daland Fund	7,000.00		
Carnegie Library Fund	3,280.79		
Charles F. Brush Endowment Fund	411.38		
		167,084.89	
			206,647.32
			$207,868.43

Disbursements:			
Salaries—Executive Office		$ 10,500.00	
Salaries—Librarian and Assistant Librarians		8,770.00	
Secretaries' Expenses		2,622.74	
Telephone		411.34	
Publication Expenses		27,926.39	
Books and Binding		7,445.84	
Camera Expenses		281.98	
Insurance		1,705.94	
Meetings		7,217.78	
Hall Expenses		3,086.66	
Hall Equipment, Alterations and Repairs		1,644.74	
Library Rental (Drexel Building)		8,700.00	
Entertaining Delegates to Eighth American Scientific Congress		652.00	
Reception in Honor of University of Pennsylvania (Bicentennial)		562.95	
Expenses re Ambassador Bullitt's Address—Independence Square		245.86	
Bench in Christ Church Graveyard		50.00	
Investment Counsel Fees		1,458.33	
Legal Services		1,281.64	
Auditing Fees		1,120.00	
Treasurer's Expense		243.15	
Research Fund Grants:			
Penrose Fund	$57,609.90		
Johnson Fund	8,186.66		
Daland Fund	6,000.00		
		71,796.56	
Research Expenses		404.37	
Typewriters and Repairs		177.12	
Photos and Information re Mortgages		1.75	
Treasurer's Commissions	$ 6,036.85		
Agent's Commission (Girard Trust Company, Carnegie Fund)	123.18		
	$ 6,160.03		
Charged Other Funds	5,312.07		
		847.96	
			159,155.10
Balance, December 31, 1940—General Fund			$ 48,713.33
Grant from Carnegie Corporation of New York for Investigation on Methods and Results of Adult Education in Science:			
Balance Unexpended January 1, 1940		$ 10,727.14	
Receipts:			
Carnegie Corporation of New York	$ 8,500.00		
Sale of Publications	30.70		
		8,530.70	
		$ 19,257.84	
Expended		11,137.23	
Balance Unexpended, December 31, 1940			8,120.61
Total			$ 56,833.94

Note:

The following General Fund appropriations for 1940 balances are carried forward:

Books and Binding		$ 5,324.60
Publication Expenses		20,255.90
Research Fund:		
Penrose Fund	$35,682.33	
Johnson Fund	9,753.34	
Daland Fund	1,000.00	
		46,435.67
		$ 72,016.17

SCHEDULE IV

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1940

WOOD FUND—PERSONALTY

Principal Account

Balance, January 1, 1940		$1,146.93
Receipts:		
Investments sold or redeemed		3,400.00
		$4,546.93
Disbursements:		
Transferred to Wood Fund—Real Estate Principal Account	$4,000.00	
Expenses re Mortgages and Sale of Investments	5.49	
		4,005.49
Balance, December 31, 1940		$ 541.44

Income Account

Balance, January 1, 1940		$ 263.94
Receipts:		
Income from Investments		5,596.12
		$5,860.06
Disbursements:		
Treasurer's Commission	$ 279.82	
Transferred to Wood Fund—Real Estate Principal Account	4,500.00	
Expenses re Mortgages	4.75	
		4,784.57
Balance, December 31, 1940		$1,075.49

SCHEDULE V

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1940

WOOD FUND—REAL ESTATE

Principal Account

Balance, January 1, 1940		$ 4,333.75
Receipts:		
Transferred from Wood Fund—Personalty:		
Principal Account	$ 4,000.00	
Income Account	4,500.00	
Transferred from Wood Fund—Real Estate Income Account	12,000.00	
Sale of Davidson and Kennedy Farms in Middlesex Co., N. J.	5,000.00	
Balance—Sale of Lots in Dade and Walker Counties, Georgia	3,500.00	
		29,000.00
		$33,333.75
Disbursements:		
Payments on account of Loan—General Fund Principal	$32,500.00	
Transfer to Wood Fund—Real Estate Income Account	260.00	
Commission on Real Estate Sales	365.00	
Expenses re Sale of Davidson and Kennedy Farms	3.40	
Expenses re Cancellation of Mortgages on Dey and Petty Farms	8.13	
		33,136.53
Balance, December 31, 1940		$ 197.22

Income Account

Balance, January 1, 1940		$12,231.89
Receipts:		
Income from Real Estate (Includes $260 from Real Estate Principal)	$50,002.11	
Adjustment and Cancellation of Insurance	130.36	
Refund of Taxes	106.81	
Sale of Steam Pump	25.00	
Miscellaneous	8.24	
		50,272.52
		$62,504.41
Disbursements:		
Taxes on Real Estate	$15,122.34	
Water Rents	388.44	
Maintenance, Repairs and Insurance	23,480.40	
General Fund Income, Interest on Advances	2,131.25	
Fee for Assessment Reduction	72.50	
Treasurer's Commission	346.53	
Transferred to Wood Fund—Real Estate Principal Account	12,000.00	
		53,541.46
Balance, December 31, 1940		$ 8,962.95

SCHEDULE VI

SUMMARY OF CASH

December 31, 1940

	Principal	Income	Total
Unrestricted Funds:			
General	$ 2,473.75	$ 56,833.94	$ 59,307.69
The Johnson Fund	49,832.69	11,761.17	61,593.86
Richard A. F. Penrose, Jr. Endowment	3,680.80	—	3,680.80
	$55,987.24	$ 68,595.11	$124,582.35
Semi-Restricted Funds:			
Magellanic Fund	—	$ 409.68	$ 409.68
François André Michaux	—	3,941.24	3,941.24
Wood Memorial Fund:			
Personalty	$ 541.44	$ 1,075.49	1,616.93
Real Estate	197.22	8,962.95	9,160.17
	$ 738.66	$ 14,389.36	$ 15,128.02
Restricted Funds:			
Library Funds:			
Thomas Balch International Law	—	$ 362.14	$ 362.14
Martin Boyé	—	382.37	382.37
Auguste Carlier	—	882.22	882.22
Carnegie Library	$ 8,377.25	—	8,377.25
Benjamin Franklin	—	457.61	457.61
Thomas Jefferson	—	324.92	324.92
Joseph Parker Norris	—	313.42	313.42
Henry Phillips, Jr.	—	6,630.83	6,630.83
Robert Proud	—	513.91	513.91
Henry Seybert	—	356.76	356.76
William Tilghman	—	119.44	119.44
	$ 8,377.25	$ 10,343.62	$ 18,720.87
Special Funds:			
Judson Daland	1,069.02	7,710.63	8,779.65
John F. Lewis Prize	—	401.05	401.05
Henry M. Phillips Prize Essay	219.62	1,643.16	1,862.78
	$ 9,665.89	$ 20,098.46	$ 29,764.35
Associated Fund	$ 1,713.11	—	$ 1,713.11
Totals	$68,104.90	$103,082.93	$171,187.83

On deposit with Fidelity-Philadelphia Trust Company (Treasurer's Account)	$103,082.93
Included among the Trust Funds (Cash) of Fidelity-Philadelphia Trust Co.	59,727.65
Included among the Trust Funds (Cash) of Girard Trust Company (Carnegie Library Fund)	8,377.25
	$171,187.83

SCHEDULE VII

GENERAL AND SPECIAL FUNDS

PRINCIPAL

December 31, 1940

	Uninvested Cash 12-31-1940	Invested 12-31-1940	Total Funds at Book Value 12-31-1940	Total Funds at Book Value 12-31-1939
Unrestricted Funds:				
General	$ 2,473.75	$ 744,331.56		
Loan to Wood Fund		50,000.00*		
	$ 2,473.75	794,331.56	$ 796,805.31	$ 804,097.63
The Johnson Fund (Endowment)	49,832.69	464,188.24	514,020.93	509,002.91
Richard A. F. Penrose, Jr. Endowment	3,680.80	4,232,620.98	4,236,301.78	4,230,038.58
Total Unrestricted Funds	$55,987.24	$5,491,140.78	$5,547,128.02	$5,543,139.12
Semi-Restricted Funds:				
Wood Memorial Fund:				
Personalty	$ 541.44	$ 109,116.40		
Real Estate	197.22	552,436.00		
Loan due General Fund		−50,000.00*		
For the construction of a building adequate to the needs of the Society, any surplus remaining to be applied to such useful purpose as counsel and officers of Society may determine				
Total Semi-Restricted Funds	$ 738.66	$ 611,552.40	$ 612,291.06	$ 601,753.08
Restricted Funds:				
Library Fund:				
Carnegie Library				
For maintenance of Library	$ 8,377.25	$ 91,882.82	$ 100,260.07	$ 100,260.07
Henry Phillips, Jr. (See Associated Fund for Additional $91,166.51 in Fund)		491.53†	491.53	
Special Funds:				
Judson Daland				
For research in clinical medicine	1,069.02	225,463.09	226,532.11	229,275.98
Henry M. Phillips Prize Essay				
Prize for essay on Science and Philosophy of Jurisprudence	219.62	12,400.00	12,619.62	12,572.34
Total Restricted Funds	$ 9,665.89	$ 330,237.44	$ 339,903.33	$ 342,108.39

* Held by Pennsylvania Co., etc., as agent.

Associated Fund:				
Thomas Balch International Law				
For books relating to the Law of Nations			$ 4,697.27	$ 4,614.08
Martin Boyé				
For books—Chemistry and Geology			3,483.11	3,470.69
Charles Francis Brush Endowment				
For general purposes			11,682.61	11,683.00
Auguste Carlier				
For books			14,478.64	14,426.99
Benjamin Franklin				
For books			10,270.91	10,234.28
Thomas Jefferson				
For books			3,867.86	3,854.07
John F. Lewis Prize				
For an award to the American Citizen who shall announce at any general or special meeting of the Society and publish among its papers some truth which the Council of the Society shall deem worthy of the award			10,514.50	10,477.00
Magellanic Fund:				
Prize for discovery or invention and for books in field of Navigation, Astronomy or National Philosophy			5,763.33	5,742.77
François André Michaux				
For books on Forestry			54,850.63	54,654.97
Joseph Parker Norris				
For books			4,814.16	4,796.99
Henry Phillips, Jr.				
For books on Archaeology and Philology (See Restricted Funds for Additional $491.53 in Fund)			91,166.51	89,990.63
Robert Proud				
For books			5,897.48	5,876.44
Henry Seybert				
For books			3,953.05	3,938.95
William Tilghman				
For books			2,103.36	2,095.85
Total Associated Fund	$ 1,713.11	$ 225,830.31	$ 227,543.42	$ 225,856.71
Total All Funds	$68,104.90	$6,658,760.93	$6,726,865.83	$6,712,857.30

Brought forward—Total All Funds	$68,104.90	$6,658,760.93	$6,726,865.83	$6,712,857.30

Invested in:		
U. S. Government Obligations	$1,975,734.84	$2,228,734.84
Foreign Government Bonds	100,000.00	100,000.00
State, County and Municipal Bonds	610,945.00	634,945.00
Railway, Utility, Industrial and Other Bonds	1,346,218.33	1,284,876.00
Stocks	1,977,545.33	1,596,602.09
Mortgages and Mortgage Participations	77,344.47	80,071.74
Real Estate and Real Estate Participations	565,351.76	579,127.91
Perpetual Fire Insurance Policies (including prepaid value—Fine Arts Policy)	5,621.20	819.70
	$6,658,760.93	$6,505,177.28
Uninvested Cash	68,104.90	207,680.02
	$6,726,865.83	$6,712,857.30

SUMMARY OF INCREASE IN INVESTMENTS

Balance at Book Value 12-31-1939		$6,505,177.28
Add:		
Interest in undivided assets from Executors of Estate of Henry Phillips, deceased		491.53
Stock Dividend of 75 shares of American Cyanamid Co. 5% Cum. Pfd. 3rd Ser. received on 500 shares American Cyanamid Co. class B Common		843.75
Investments Purchased at cost		721,654.61
		$7,228,167.17
Deduct:		
Investments sold ($562,154.16) at book value	$565,233.05	
Premiums charged off on Bonds purchased for other than Associated Fund	4,153.49	
Adjustment—Perpetual Fire Insurance Policy	19.70	
		569,406.24
Balance at Book Value 12-31-1940		$6,658,760.93

SCHEDULE VIII

BUILDING FUND—GIRARD TRUST COMPANY, TRUSTEE

CASH RECEIPTS AND DISBURSEMENTS

Year ended December 31, 1940

Principal Account

Balance, January 1, 1940		$195,392.67
Receipts:		
Mortgages paid in part	$ 1,055.04	
Real Estate Sold, etc.	6,066.43	
Estate of Henry G. Bryant, Deceased—on account of principal	.34	
Transferred from Income Account	7,922.08	
		15,943.89
		$211,336.56
Disbursements:		
Invested in Bonds	$204,200.84	
Invested in Mortgage	1,336.74	
Cost of reconditioning real estate	68.46	
Forwarding Charges on Investments Purchased	1.81	
		205,607.85
Balance, December 31, 1940		$ 5,728.71

Income Account

Receipts:		
Income from Investments	$ 14,633.11	
Estate of Henry G. Bryant, Deceased—on account of income	58.43	
		$ 14,691.54
Disbursements:		
Real Estate Expenses	$ 3,499.92	
Commission—Girard Trust Company	612.26	
Notary Fee	.50	
Transferred to Principal Account	7,922.08	
Transferred to Fidelity-Philadelphia Trust Company, Treasurer (General Fund) in reimbursement for alterations and furnishing of Society's building, etc.	1,826.01	
Accrued Interest on Bonds Purchased	830.77	
		$ 14,691.54

SCHEDULE IX

BUILDING FUND—GIRARD TRUST COMPANY, TRUSTEE

SUMMARY OF ASSETS

	Balance 1-1-1940	Additions	Deductions	Balance 12-31-1940
Pledges Receivable	$ 11,229.17	——	——	$ 11,229.17
Investments:				
Bonds (Par Value)	102,500.00	$187,500.00	——	290,000.00
Stocks (At Cost)	49,644.13	——	——	49,644.13
Mortgages (Participations)	152,619.23	1,336.74	$ 1,955.04	152,000.93
Real Estate (Participations)	125,371.37	68.46	7,616.18	117,823.65
Cash—Principal	195,392.67	15,943.89	205,607.85	5,728.71
Cash—Income	——	14,691.54	14,691.54	——
	$636,756.57	$219,540.63	$229,870.61	$626,426.59*

SUMMARY OF DECREASE IN FUND

Year ended December 31, 1940

Income from Investments	$14,633.11		
Less:			
Accrued Interest on Bonds Purchased	830.77		
		$13,802.34	
Estate of Henry G. Bryant, Deceased—on account of Principal and Income		58.77	
			$ 13,861.11
Less:			
Real Estate Expenses		3,499.92	
Premiums on Bonds Purchased		16,700.84	
Transferred to Fidelity-Philadelphia Trust Company, Treasurer (General Fund) in reimbursement for alterations and furnishing of Society's building, etc.		1,826.01	
Loss on Sale of Real Estate Participation		1,549.75	
Commission—Girard Trust Company		612.26	
Forwarding Charges on Investments Purchased		1.81	
Notary Fee		.50	
			24,191.09
Decrease in Fund			$ 10,329.98
Balance, January 1, 1940			636,756.57
Balance, December 31, 1940			$626,426.59

*Includes bonds at Par Value. Total Fund including bonds at cost is $638,846.18.

VI

SPECIAL COMMITTEES

1. REPORT OF THE COMMITTEE ON EDUCATION AND PARTICIPATION IN SCIENCE

By W. Stephen Thomas, *Executive Secretary*

I. Committee

On June 1, 1939, the Committee on Education and Participation in Science commenced to operate under a policy determined by its Committee on Organization. This Committee consisted originally of the following members of the American Philosophical Society: Anton J. Carlson, Edwin G. Conklin, *Chairman*, Karl K. Darrow, Luther P. Eisenhart, C. E. Kenneth Mees, Harlow Shapley, George G. Simpson, W. F. G. Swann, Rodney H. True, Harold C. Urey and Roland S. Morris, *ex-officio*. Since that time, the Committee suffered the loss, through death, of Dr. True and added to its numbers Dr. Oscar Riddle and Dr. Edward L. Thorndike.

With its program made possible by an original grant received through the courtesy of the Carnegie Corporation of New York in March, 1939, of $15,740.29, the Committee was the recipient of an additional grant of $8,500 in April, 1940. The balance remaining of these grants on December 31, 1940, was $8,680.50. The purposes of the Committee are:

a. To conduct a survey of amateur science in the Philadelphia area.
b. To stimulate participation of laymen in scientific research.

The actual program has been carried out by an Executive Staff with Roland S. Morris as Chairman, four part-time consultants and an Executive Secretary working on a full-time basis. The personnel of the Executive Staff is as follows: Roger Conant, Consultant in Zoology; John M. Fogg, Jr., Consultant in Botany; Serge A. Korff, Consultant in Physics and Astronomy; Edward E. Wildman, Consultant in General Science; and W. Stephen Thomas, Executive Secretary.

This report presents briefly the work accomplished to date, along with conclusions and prospects for future progress.

II. Survey

Since June, 1939, the Committee has carried on an intensive study of the interests and needs of amateur scientists and amateur scientific organizations within a thirty mile radius of Philadelphia. This has been accomplished by questionnaires, interviews with club officers and personal visits by the consultants. Statistics have been obtained which show that there are 287 organizations (40 in the pure sciences and 247 in the applied sciences), representing 32,000 members. These include groups in astronomy, bird study, botany, microscopy, mechanics, horticulture, photography, radio and many other fields. In addition, a study was made of the facilities for adult education and research in science by laymen. These facilities comprise seventy-two museums, institutes, libraries, arboreta, observatories and other resources. The facts of the survey have just appeared in printed form in "The Layman Scientist in Philadelphia: A Directory of Amateur Scientific Organizations and Resources in Science," an illustrated booklet of forty-four pages. An analysis of the organizations of lay-scientists, under the title of "Amateur Scientists and Their Organizations," by W. Stephen Thomas, appeared in *The Scientific Monthly* for January, 1941.

III. Research Programs

Perhaps the most important work of the Committee has been the experimental program which it sponsors for laymen in order to stimulate participation in science and contribution to research. The projects were planned and carried out by the Executive Staff so that they would require a minimum of equipment and would suit many types of people. The four projects, in botany, climatology, physics and zoology, started on April 1, 1940, have met with gratifying response. Five hundred persons have taken part in this work.

A. Botany Project

Purpose. To accumulate data on the blooming and fruiting of native wild plants through tabulations of dates and weather conditions on charts kept by volunteer laymen acting as observers.

How Carried Out. Planned and supervised by Dr. John M. Fogg, Jr., this project was started on April 1, 1940, designed for the spring blooming season with a chart listing thirty species of plants. The program met with such success that the observers requested a similar list for summer blooming species. Accordingly, a second chart of this type, with eighty-five species, was distributed on July 1. Carefully prepared instruction sheets accompanied each list. A campaign of publicity, through the means of twenty talks to clubs by Dr. Fogg and Mr. Thomas, one hundred and seventeen personal letters and fifteen articles in newspapers throughout the Philadelphia area, resulted in the distribution of over two hundred charts to volunteers. Altogether, fifty-one charts, with much information, were returned, representing intensive work of forty-one persons observing in thirty-three localities. Each chart represented an average of from twelve to thirty visits to the individual plants under observation. In many cases, the region being studied was miles from the home of the observer.

Comments from Amateurs. One observer who compiled excellent records of twenty-five species in a city park also made a detailed map of the locality. A young woman who received a chart replied, "On your list there were names of flowers I have never seen or heard of before. With the aid of a flower book, I soon learned about them and then became aware of them in the country. You see, in this way, you have helped me more than I have helped you." Another enthusiastic amateur wrote, "Never has a spring been more enjoyable, chiefly because of the frequent trips to the woods to get data for the chart."

Conclusion and Prospect. The two study meetings held by Dr. Fogg at the conclusion of each season's program proved beneficial to all participating. Many improvements in technique and planning were suggested. There was a strong sentiment expressed that the project be continued another year. As some persons found difficulty in identifying some species, Dr. Fogg has made plans to provide a simple manual for field work. Many requests from garden club members have led to the formation of a list of cultivated plants, supplementing the wild species which could be easily observed by amateur gardeners. It will be seen in conclusion, therefore, that, based on this pioneer effort this year, the Committee finds itself in a strong position for launching an efficient phytophenological, or blooming date, study for 1941.

B. Radio and Ionosphere Project for Amateurs

Purpose. To determine facts concerning the ionosphere, or Heaviside layer, through the recording of receptions, fade-outs and skip-distance occurrences in the course of amateur radio communication. Dr. Serge A. Korff devised and supervised the project.

How Carried Out. During June and July 1940, seventeen hundred licensed radio amateurs were circularized by a mimeographed letter from the Committee. These persons were invited to take part in the work as volunteers, by filling out the required information on log forms especially prepared by Dr. Korff. Two hundred persons wrote to the Committee requesting log forms. Since then fifty persons have actively cooperated by filling out over two hundred of these charts, each chart representing communication with ten or more stations. The combined time of these workers totals hundreds of hours. In reducing the data of these logs, one of the amateurs, Mr. John J. Byrne, a clothing store clerk, devoted an astonishing amount of time to this task. The results so far obtained have been studied by Mr. L. V. Berkner of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington. Mr. Berkner gave a stimulating report on his findings before an informal meeting of thirty-five amateurs at the American Philosophical Society. It is gratifying to report that the request for the aid of these amateurs met with enthusiasm on their part and and a strong desire to be of assistance to research scientists.

Prospects. As suggested, and in the light of experience gained thus far, the procedure in making the observations has been rearranged in order to produce maximum efficiency. New instruction sheets are now being distributed providing for the systematic guarding of all frequencies on the radio spectrum at one particular time. The purpose of keeping the logs in this manner is to prepare skip-distance charts showing the world-wide state of the ionosphere at as frequent intervals as feasible.

Conclusion. Present professional ionosphere research is necessarily limited by the size of existing staffs at the few institutions now engaged in the work. In most cases it is not possible for these workers to make observations over wide areas or to do experiments with other than the regular vertical incidence apparatus. Yet a complete series of observations at oblique incidence is of immense value in interpreting ionosphere phenomena. This is the type of

observation which is now being obtained by the cooperation of a group of amateurs. Because of their numbers, they can provide information which professional research workers would find it difficult otherwise to obtain. The observations are so planned that they provide an important supplement to the work of the professionals.

C. Climatological Study of Delaware Valley through Tree Ring Records

Purpose. To obtain data in the form of strip records showing "signatures," or patterns, of the annual growth rings of ancient trees in order to determine the weather history of the Delaware Valley prior to 1840. The records to be obtained by volunteer observers and data compiled by them.

How Carried Out. The project was proposed and developed by Dr. Edward E. Wildman, Consultant of the Committee. In 1932, Dr. Wildman obtained the help of several hundred persons in locating trees which had been standing since the time of William Penn's landing in Pennsylvania in 1682. The present project, calling for cooperation in reporting on logs, stumps and timbers of ancient buildings and the obtaining from them of paper strip records of their growth rings, was launched on Arbor Day, April 19, 1940. Four hundred persons were circularized by letter. As a result, one hundred of these persons communicated information, tree ring records, and in many cases, actual specimens. The persons replying were located in sixty-four different towns and cities throughout the Delaware Valley. Almost fifty sample tree sections have now been obtained. Four study meetings have already been held at the Academy of Natural Sciences under Dr. Wildman's supervision and others are scheduled. Volunteers are of all sorts; participants include: a physician, a fruit-grower, a builder, two teachers, two students, an actress in amateur dramatics and a janitor. A three-page mimeographed publication, "The Tree Ring Log," issued every three months by the Committee, contains contributions from the amateurs and instructions for them. In addition, a nation-wide broadcast, "Tree Rings Tell Interesting Stories," by Dr. Wildman, was circulated through the courtesy of *Science Service*. The same story appeared, with a special supplement, in *Forest Leaves*, September–October 1940 issue. This pub-

lication reached 1,100 members of the Pennsylvania Forestry Association. As a result of such publicity, many inquiries were received.

Conclusion and Prospect. The climatological study for amateur collaborators is a pioneer attempt to assemble data in the form of records of past weather history as revealed in tree rings. It is hoped that the information obtained by the amateurs will be examined, checked and compiled by professional dendrochronologists. The latter include associates of Dr. A. E. Douglass of the University of Arizona, Mr. F. Martin Brown of Colorado Springs, Colorado, and others. The various techniques of obtaining tree ring strip records, the use of ancient timbers, the correlation of other records in unpublished letters and diaries, all represent a new venture for this region. On the other hand, the participation of amateur workers under professional guidance has already shown its beneficial effects in stimulating self-education and original investigation.

D. Zoology Project—Study of Animal Life Histories through Tagging and Marking by Volunteer Naturalists

Purpose. To mark, for future recognition, specimens of certain local amphibians, reptiles, and insects so that their habits and life histories may be more accurately studied.

How Carried Out. The project was suggested and supervised by Mr. Roger Conant, Consultant of the Committee. Beginning in the late spring of 1940 and continuing to the present time, the work has focused on frogs, turtles, snakes, and a few of the singing insects, depending upon seasonal conditions. To date, fifty-two persons have actually participated under the direction of Mr. Conant. Some of these persons have contributed several hundred hours to the project. Considering the fact that the work involves going into the field, capturing, weighing, measuring and tagging animals and releasing them, it is felt that this number of persons bespeaks real enthusiasm. The participants include a physician, teachers, stenographers, business men and women, while some are students or camp counselors. One collaborator wrote, ". . . my work was done on DeKay snakes which were found under boards, rocks, tarpaper and cardboard. I am going to try to take thermometer readings under the cardboard and tarpaper. This will, I hope, tell me whether the snakes go under such shelters during the warm

weather for coolness or for warmth in the cooler weather." Two high school students, working together, report, "We have enjoyed doing the work this summer and we both feel that next summer it will be possible to get much more done."

Conclusion and Prospect. It is too early as yet to make any claims on how much scientific information has been gathered. Mr. Conant states, "I look upon the year's activities as purely experimental and as being useful, chiefly, in training amateurs how to go about the work and how to develop new thoughts of their own. We do, however, have a good conception of the size and weight at which bull-frog tadpoles transform into the adult form and many data available on the movements and habits of snakes, turtles and katydids. Next year, with many months of preparation and training behind us, we should begin to obtain considerably greater results."

IV. Additional Means of Stimulating Amateur Activity in Science

Publications of Committee. Since October 1, 1939, twelve monthly issues of a four page, printed leaflet, "Activities in Science in the Philadelphia Area," have been published by the Committee. This calendar of educational and participation activities for laymen in the pure sciences now reaches a selected list of 1,200 amateur scientists, many of whom are actively cooperating. An average of fifty events, such as lectures, demonstrations, field trips and radio broadcasts, are listed monthly.

"The Layman Scientist in Philadelphia: A Directory of Amateur Scientific Organizations and Resources in Science," in an issue of 2,500 copies, appeared on November 13, 1940. This forty-four-page, illustrated handbook, with hitherto uncollected information, represents a sixteen months' intensive survey by the Committee. Over six hundred copies have already been sold and it has been widely circulated both in Philadelphia and throughout the country.

Stimulation of Amateur Activity Through Talks. One of the chief means of reaching the science-minded portion of the public for interpreting the Committee's work has been the spoken word. The Executive Staff, from January 1, 1940, to December 31, 1940, gave a total of eighty-three talks before a visible audience of 3,603 persons in addition to a large unestimated group of radio listeners. Of these talks the Executive Secretary presented forty-five.

The groups reached varied widely and comprised amateur scientific bodies, garden and women's clubs, institutes, museum audiences and adult school classes. Although the major portion of these talks centered on the research projects for amateurs, the following topics were also presented: "Hobbies for Women," "Community Resources in Science," "Science and Democracy" and "Benjamin Franklin; Scientist and Educator."

Publicity in Print. Articles on the survey and program of the Committee written by the Executive Secretary, as well as others, have appeared in eleven magazines, including *Science, The Scientific Monthly, School and Society, Science News Letter, Journal of Adult Education, Popular Science Monthly,* etc. Over thirty-five articles, a number of them illustrated, have appeared in local and out-of-town newspapers. Grateful acknowledgment is made to the Philadelphia Transportation Company which, through its lecture circulars and other literature, has publicized the opportunities offered by the Committee.

Local Aid Rendered to Stimulate Amateur Science. The Committee, through the office of the Executive Secretary, has been called upon repeatedly for advice and assistance in stimulating amateur science in various ways in the Philadelphia community. Some forty requests have come by telephone and letters from amateur scientists, educators and others. Samples of aid rendered include suggestions for the formation of clubs, plans for adult education courses in science, information on speakers, field trips, reference books and scientific instruments.

At the request of the Free Library of Philadelphia, through its Librarian, Franklin H. Price, the Committee is now at work compiling a series of popular books in various fields of science, approved by scientists. The Committee has also been instrumental in founding the Philadelphia Council of Amateur Scientists. This Council is an affiliation of thirty-five organizations devoted to the pure and applied sciences. Largely self-organized, with the purpose of disseminating interest and participation in science on the part of amateurs, it is the first laymen's league of its kind. Four meetings have been held in the rooms of the American Philosophical Society, a constitution has been adopted and officers elected.

Another important movement toward spreading opportunity for an understanding of science, as well as in other fields of knowledge among the public, is the Adult Education Council for Philadelphia, founded in 1940. The Executive Secretary of the Com-

mittee has been active in organizing this federation of sixty-five different agencies, covering the fields of community affairs, social service, religion, museums, libraries and general education.

A further evidence of stimulation of amateurs active in research in science can be seen in the case of the Geographical Society of Philadelphia. It has appointed a committee and employed a research director to plan programs for members in the fields of geology and geography. Dr. Serge A. Korff is a member of the committee.

Aid to Other Communities. As the work of the Committee represents a pioneer venture for bridging the gap between scientific research and the lay public, wide-spread interest in its activities has been manifest in many parts of the country. To date, inquiries as to how to sponsor amateur research and adult education in science have been received from individuals and organizations in twenty towns and cities in twelve states and from the Philippines, Costa Rica and Guatemala. Requests have been received from universities, school boards, game commissions, museums, the National Park Service and from the academies of science in Chicago, Maryland and Michigan.

V. General Conclusions

The preceding report leads to the following conclusions:

1. The survey of the Committee, in revealing that there are in Philadelphia 287 clubs and societies of amateurs, with 32,000 members, in the pure and applied sciences, shows conclusively that in one metropolitan area layman interest in science is more widely spread and constructive than has hitherto been known.

2. The fact that the Committee now has in operation, under its auspices, four different research projects in which over five hundred individuals have taken part, shows that amateur contributions to the making of original observations and the compilation of records under supervision is feasible.

3. The Committee has strengthened local amateur scientific organizations as attested by the establishment of the Philadelphia Council of Amateur Scientists and has evolved techniques for stimulating the participation of the lay public in scientific activities leading to self-learning and original investigation.

4. The Committee has started to provide information useful to research scientists through the cooperative efforts of non-professionals.

VII

AWARDS OF PRIZES

MAGELLANIC FUND, established in 1786 by the gift of 200 guineas by John Hyacinth de Magellan, of London, for a gold medal to be annually awarded under prescribed terms, to the author of the best discovery or most useful invention relating to navigation, astronomy, or natural philosophy (mere natural history only excepted). Any surplus of interest remaining to be used for such purposes as may be authorized under the Society's Charter and Laws.

Awards of the Magellanic Premium

December 1790. To FRANCIS HOPKINSON, Philadelphia, Penna. For the Invention of the Spring Block. "Description of a Spring Block Designed to Assist a Vessel in Sailing" (TRANS. Amer. Philos. Soc. **3**, Art. 40, 1793).

December 1792. To ROBERT PATTERSON, Philadelphia, Penna. For the Improvement of Electrical Rods, or Lightning Conductors, by Pointing them with Black-lead. "An Improvement on Metalic Conductors or Lightning-rods in a Letter to Dr. David Rittenhouse from Robert Patterson" (TRANS. Amer. Philos. Soc. **3**, Art. 35, 1793).

December 1792. To WILLIAM THORNTON, London, England. For "Cadmus" or a Philosophical Dissertation on the Elements of Written Language. "Cadmus, or a Treatise on the Elements of Written Language, illustrating, by a Philosophical Division of Speech, the power of each Character, thereby mutually fixing the Orthography and Orthoepy. With an Essay on the Mode of Teaching the Surd, or Deaf and Consequently Dumb to Speak" (TRANS. Amer. Philos. Soc. **3**, Art. 33, 1793).

December 1794. To NICOLAS COLLIN, Philadelphia, Penna. For a Paper on an Elevator (Nititor [sic] in ardua virtus). "Description of a Speedy Elevator by the Inventor" (TRANS. Amer. Philos. Soc. **4**, Art. 75, 1799).

November 1804. To CAPTAIN WILLIAM MUGFORD, Salem, Mass. For the Invention of a Temporary Rudder. "An account and description of a Temporary Rudder Invented by Capt. William Mugford of Salem, Mass." (TRANS. Amer. Philos. Soc. **6**, Art. 34, 1809).

December 1804. To DR. BEN SMITH BARTON, Philadelphia, Penna. For a Paper on a "Number of the Pernicious Insects of the United States."

October 1807. To JOHN GARNETT, New Brunswick, N. J. For a Paper on "A New Simple Nautical Chart." "Description and use of a new and simple Nautical Chart, for working the different problems in Navigation" (TRANS. Amer. Philos. Soc. **6**, Art. 49, 1809).

April 1809. To JAMES HUMPHRIES, JR., Philadelphia, Penna. For a Model and Description of Steering Apparatus.

April 1820. To JOSHUA CHAPMAN, Bristol, Penna. For an Improvement in the Manufacture of Canvas.

March 1823. To DR. JAS. EWING, Philadelphia, Penna. For the invention of the "Improved Hydrant."

May 1825. To C. C. BRODIE. For an invention to repair the side of ships, under the surface of the water.

March 1836. To JAMES P. ESPY, Philadelphia, Penna. Author of the paper signed "Investigator."

December 1864. To PLINY EARLE CHASE, Philadelphia, Penna. For a paper on "The discovery of Certain new relations between the solar- and lunar-diurnal variations of magnetic force and of barometric pressure" (PROC. Amer. Philos. Soc. **9**: 487–495).

December 1887. To LEWIS M. HAUPT, Philadelphia, Penna. For a paper on "The Physical Phenomena of Harbor Entrances. Their Causes and Remedies. Defects of Present Methods of Improvement" (PROC. Amer. Philos. Soc. **25**: 19–41).

April 1922. To PAUL R. HEYL AND LYMAN J. BRIGGS, U. S. Bureau of Standards, Washington, D. C. For the invention of the Earth Inductor Compass. "The Earth Inductor Compass" (PROC. Amer. Philos. Soc. **61**: 15–32).

THE HENRY M. PHILLIPS PRIZE ESSAY FUND, established in 1888 by the gift of $5,000 by Miss Emily Phillips, of Philadelphia. Income to be used in the awarding of a prize for the best essay of real merit on the science and philosophy of jurisprudence.

Awards of The Henry M. Phillips Prize Essay

May 1895. To GEORGE H. SMITH, ESQ., Los Angeles, Calif. $500. "The Theory of State" (PROC. Amer. Philos. Soc. **34**: 181–334).

June 1900. To W. H. HASTINGS, ESQ., Wilber, Neb. $2,000. "The Development of Law as Illustrated by the Decisions Relating to the Police Power of the State" (PROC. Amer. Philos. Soc. **39**: 359–554).

April 1912. To CHARLES H. BURR, ESQ., Philadelphia, Penna. $2,000. "The Treaty-Making Power of the United States and the Methods of its Enforcement as Affecting the Police Powers of the States" (PROC. Amer. Philos. Soc. **51**: 271–422).

April 1921. To QUINCY WRIGHT, ESQ., Minneapolis, Minn. $2,000. "The Relative Rights, Duties and Responsibilities of the President, of the Senate and the House, and of the Judiciary in Theory and Practice" (PROC. Amer. Philos Soc. **60**: 99–455).

October 1935. To LON L. FULLER, Dean of the Law School, Duke University, Durham, N. C. $1,500 and Diploma. "American Legal Realism" (PROC. Amer. Philos. Soc. **76**: 191–235).

THE JOHN F. LEWIS FUND, established in 1935 by the gift of Mrs. John F. Lewis, of Philadelphia, of $10,000 in memory of her late husband; the income to be used each year as an award to the American citizen who shall announce at any general or special meeting of the Society, and publish among its papers, some truth which the Council of the Society shall deem worthy of the award.

Awards of The John F. Lewis Prize

April 1937. To RALPH E. CLELAND, Goucher College, Baltimore, Md. $300 and Diploma, for presentation to the Society and publishing in its PROCEEDINGS: "Cyto-taxonomic Studies on Certain Oenotheras from California" (Read April 19, 1934,—PROC. Amer. Philos. Soc. **75**: 339–429). "A Cyto-genetic and Taxonomic Attack upon the Phylogeny and Systematics of Oenothera (Evening Primrose) with Special Reference to the Sub-genus Onagra" (Read April 18, 1935,—PROC. Amer. Philos. Soc. **77**: 477–544).

April 1938. To ARTHUR J. DEMPSTER, University of Chicago, Chicago, Ill. $300 and Diploma, for presentation to the Society and publishing in its PROCEEDINGS: "New Methods in Mass Spectroscopy" (Read in part April 20, 1935,—PROC. Amer. Philos. Soc. **75**: 755–767). "Further Experiments on the Mass Analysis of the Chemical Elements" (Read April 25, 1936,—PROC. Amer. Philos. Soc. **76**: 491–496).

April 1939. To HENRY NORRIS RUSSELL, Princeton University Observatory, Princeton, N. J. $300 and Diploma, for presentation to the Society and publishing in its PROCEEDINGS: "Stellar Energy" (Read February 17, 1939,—PROC. Amer. Philos. Soc. **81**: 295–307).

April 1940. To EARLE RADCLIFFE CALEY, Princeton University, Princeton, N. J. $300 and Diploma, for presentation to the Society and publishing in its MEMOIRS: "The Composition of Ancient Greek Bronze Coins" (Read November 27, 1937,—MEM. Amer. Philos. Soc. **11**: 1–203).

VIII

GENERAL MEETING LECTURERS

THE R. A. F. PENROSE, JR., LECTURERS

1934. Edwin G. Conklin
"A Generation's Progress in the Study of Evolution"
1935. W. F. G. Swann
"Is the Universe Running Down?"
1936. Dixon Ryan Fox
"The American Tradition in a New Day"
1937. Irving Langmuir
"The Surfaces of Solids and Liquids"
1938. S. A. Mitchell
"With an Astronomer on an Eclipse Expedition"
1939. Eduard Beneš *
"Politics as Art and Science"
1940. Archibald MacLeish
"Writers and Scholars"

SPECIAL LECTURER

1940. Dayton C. Miller
"The Pipes of Pan, Old and New"

THE AUTUMN LECTURERS

1936. D'Arcy W. Thompson
"Astronomy in the Classics"
1937. William Lyon Phelps *
"Truth and Poetry"
1938. Alfred J. Lotka
"Contacts of Population Study with Related Branches of Science"
1939. Carlton J. H. Hayes
"The Novelty of Totalitarianism in the History of Western Civilization"
1940. Edward S. Corwin *
"Some Aspects of the Presidency"

* Franklin Medal presented.

IX

REPRESENTATION AT CELEBRATIONS OF SOCIETIES, INSTITUTIONS, ETC.

January 17. Celebration of the birthday of Benjamin Franklin at the Benjamin Franklin Memorial, Philadelphia, by the Poor Richard Club of Philadelphia and the Franklin Institute of Pennsylvania. John A. Miller, William E. Lingelbach, Mrs. William E. Lingelbach, Mrs. Gertrude D. Hess.

April 12–13. Forty-fourth Annual Meeting of the American Academy of Political and Social Sciences, Philadelphia. Solomon S. Huebner.

May 10. Dedication of the statue of Benjamin Franklin in the Federal Building by the United States World's Fair Commission. Harold C. Urey.

May 10–18. Eighth American Scientific Congress under the auspices of the United States Department of State, Washington, D. C. Roland S. Morris, James Brown Scott, Frederick P. Keppel, J. C. Merriam, Edwin G. Conklin.

June 8–9. Dedication of the buildings of the University of Colorado, Boulder, Colorado. Theodore D. A. Cockerell.

September 9–11. Conference on Science, Philosophy and Religion in their Relation to the Democratic Way of Life, at the Jewish Theological Seminary of America, New York City. James A. Montgomery.

September 16–21. Bicentennial Celebration of the University of Pennsylvania. Waldo G. Leland.

Emergency Committee in Aid of Displaced Foreign Scholars. Harold C. Urey.

American Council of Learned Societies, Washington, D. C., (for four years, 1937–41; reappointed for 1941–45). Edward Capps; (for four years, 1938–42). William E. Lingelbach.

National Research Council, Division of Foreign Relations, Washington, D. C., (for three years, 1940–43). Leo S. Rowe.

X

LIST OF MEMBERS

MEMBERS RESIDING WITHIN THE UNITED STATES

Date of Election

Abbot, Charles Greeley, M.Sc., D.Sc., LL.D. 1914
Astrophysicist, Secretary, Smithsonian Institution,
Washington, D. C.

Adams, Edwin Plimpton, M.S., Ph.D., Sc.D. 1915
Professor of Physics, Princeton University,
Princeton, N. J.

Adams, James Truslow, A.M., LL.D., Litt.D., L.H.D. 1938
Author, American Historian.
Sheffield House, Southport, Conn.

Adams, Joseph Quincy, Ph.D., Litt.D. 1940
Director, Folger Shakespeare Library.
2915 Foxhall Road, N.W., Washington, D.C.

Adams, Roger, A.B., A.M., Ph.D., Sc.D. 1935
Head of the Chemistry Department, University of Illinois.
603 Michigan Avenue, Urbana, Ill.

Adams, Walter Sydney, A.M., Sc.D., LL.D. 1915
Astronomer, Director, Mount Wilson Observatory,
Pasadena, Calif.

Aitken, Robert Grant, A.M., Sc.D., LL.D. 1919
Astronomer, Director Emeritus, Lick Observatory.
1109 Spruce Street, Berkeley, Calif.

Albright, William F., Ph.D., Litt.D., D.H.L., Th.D. 1929
Orientalist and Archaeologist, Professor of Semitic
Languages, Johns Hopkins University, Baltimore, Md.

Alexander, James W., A.M., Ph.D., A.A. 1928
Professor of Mathematics, Institute for Advanced Study.
29 Cleveland Lane, Princeton, N. J.

Date of Election

Allen, Charles Elmer, B.S., Ph.D. 1922
Professor of Botany, University of Wisconsin.
2014 Chamberlin Avenue, Madison, Wis.

Anderson, Carl David, Ph.D. 1938
Professor of Physics, California Institute of Technology, Pasadena, Calif.

Andrews, Charles McLean, Ph.D., L.H.D., Litt.D., LL.D. 1924
Professor Emeritus of American History, Yale University. 424 St. Ronan Street, New Haven, Conn.

Andrews, Donald Hatch, A.B., Ph.D. 1933
Chairman, Chemistry Department, Director, Chemistry Laboratory, Johns Hopkins University, Baltimore, Md.

Andrews, Roy Chapman, M.A., Sc.D. 1927
Zoologist, Director, American Museum of Natural History, New York, N. Y.

Angell, James Rowland, A.B., A.M., Ph.D., Litt.D., LL.D. 1924
Psychologist, President Emeritus, Yale University; Educational Counselor, National Broadcasting Company.
155 Blake Road, Hamden, New Haven, Conn.

Armstrong, Edward Cooke, A.B., Ph.D., LL.D., L.H.D. 1932
Professor of French Language, Princeton University.
26 Edgehill Street, Princeton, N. J.

Armstrong, Hamilton Fish, A.B. 1940
Writer; Editor, *Foreign Affairs*.
45 East 65th Street, New York, N. Y.

Arthur, Joseph Charles, Sc.D., LL.D. 1919
Professor Emeritus of Botany, Purdue University.
915 Columbia Street, Lafayette, Ind.

Aydelotte, Frank, A.M., B.Litt., L.H.D., LL.D., D.Litt., D.C.L. 1923
Educator, Director, Institute for Advanced Study, Princeton, N. J.

Baekeland, Leo H., D.Sc., D.Nat.Sc., D.Ch., D.Ap.Sc., LL.D. 1935
Chemist, Former President, Bakelite Corporation.
30 East 42nd Street, New York, N. Y.

Date of Election

Bailey, Irving Widmer, A.B., M.F., Sc.D. 1926
Professor of Plant Anatomy, Harvard University.
17 Buckingham Street, Cambridge, Mass.

Bailey, Liberty Hyde, Litt.D., LL.D. 1896
Botanist, Professor Emeritus of Agriculture (Horticulture), Director (ret.), Bailey Hortorium, Cornell University, Ithaca, N. Y.

Bancroft, Wilder Dwight, A.B., Ph.D., Sc.D., LL.D. 1920
Professor Emeritus of Physical Chemistry, Cornell University. 7 East Avenue, Ithaca, N. Y.

Barbour, Thomas, Ph.D., Sc.D., S.D., Dr. en Ciencias 1937
Director, University Museum and Museum of Comparative Zoology, Professor of Zoology, Harvard University.
278 Clarendon Street, Boston, Mass.

Bartlett, Harley Harris, A.B. 1929
Chairman, Department of Botany, Director, Botanical Garden, University of Michigan. 538 Church Street, Ann Arbor, Mich.

Barton, George Aaron, A.M., Ph.D., S.T.D., LL.D. 1911
Orientalist and Archaeologist, Professor Emeritus of Semitic Languages, University of Pennsylvania.
3610 Royal Palm Avenue, Coconut Grove, Fla.

Bateman, Harry, M.A., Ph.D. 1924
Professor of Mathematics, Theoretical Physics and Aeronautics, California Institute of Technology, Pasadena, Calif.

Beams, Jesse Wakefield, Ph.D. 1939
Professor of Physics, University of Virginia.
Monroe Hill, University, Va.

Beard, Charles Austin, LL.D., Ph.D. 1936
Historian, Formerly Professor of Politics, Columbia University. New Milford, Conn.

Becker, Carl L., Ph.D., Litt.D. 1936
Professor of History, Cornell University.
109 West Upland Road, Ithaca, N. Y.

Beeson, Charles Henry, Ph.D. 1940
Professor of Latin, University of Chicago.
1228 East 56th Street, Chicago, Ill.

	Date of Election
Bell, Eric Temple, Ph.D. Professor of Mathematics, California Institute of Technology. 434 South Michigan Avenue, Pasadena, Calif.	1937
Benedict, Francis Gano, Ph.D., Sc.D., M.D. Physiologist, Director (ret.), Nutrition Laboratory, Carnegie Institution of Washington (1907–37). Machiasport, Maine.	1910
deBenneville, James S., A.B. Chemist. 907 West Roosevelt Boulevard, Philadelphia, Pa.	1897
Berkey, Charles Peter, B.S., M.S., Ph.D., Sc.D. Newberry Professor Emeritus of Geology, Columbia University, New York, N. Y.	1928
Berry, Edward Wilber Professor of Paleontology, Dean, Provost, Johns Hopkins University, Baltimore, Md.	1919
Bigelow, Henry Bryant, Ph.D. Director, Woods Hole Oceanographic Institution; Professor of Zoology, Harvard University. Museum of Comparative Zoology, Cambridge, Mass.	1937
Birge, Edward Asahel, Ph.D., LL.D., Sc.D. Zoologist, President Emeritus, University of Wisconsin. 2011 Van Hise Avenue, Madison, Wis.	1923
Birkhoff, George David, Ph.D., S.D., D. (hon.), LL.D. Perkins Professor of Mathematics, Harvard University. 987 Memorial Drive, Cambridge, Mass.	1921
Blackwelder, Eliot, Ph.D. Professor of Geology, Stanford University, Calif.	1939
Blakeslee, Albert Francis, A.M., Ph.D., D.Sc. Botanist, Director, Department of Genetics, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, N. Y.	1924
Bliss, Gilbert Ames, B.S., M.S., Ph.D., Sc.D. Professor of Mathematics, Chairman, Department of Mathematics, University of Chicago, Chicago, Ill.	1926

Date of Election

Boas, Franz, Ph.D., M.D., LL.D., Sc.D. 1935
Professor Emeritus of Anthropology, Columbia University. Grantwood, Bergen County, N. J.

Bogert, Marston Taylor, A.B., Ph.B., Sc.D., LL.D., R.N.D. 1909
Professor Emeritus of Organic Chemistry in Residence, Columbia University, New York, N. Y.

Bolton, Herbert Eugene, Ph.D., D.Litt., L.H.D., LL.D. 1937
Sather Professor of History, Chairman, Department of History, Director, Bancroft Library, University of California, Berkeley, Calif.

Bonner, Campbell, A.M., Ph.D. 1938
Professor of the Greek Language and Literature, University of Michigan. 1025 Martin Place, Ann Arbor, Mich.

Bowen, Ira Sprague, Ph.D. 1940
Professor of Physics, California Institute of Technology, Pasadena, Calif.

Bowen, Norman L., M.A., B.Sc., Ph.D., Sc.D. 1930
Geologist, Charles L. Hutchinson Distinguished Service Professor of Petrology, University of Chicago, Chicago, Ill.

Bowman, Isaiah, B.S., Ph.D., M.A., D.Sc., LL.D. 1923
Geographer, President, Johns Hopkins University, Baltimore, Md.

Bridgman, Percy Williams, A.M., Ph.D., Sc.D. 1916
Physicist, Hollis Professor of Mathematics and Natural Philosophy, Harvard University. Research Laboratory of Physics, Cambridge, Mass.

Briggs, Lyman J., Ph.D., Sc.D., D.Eng., LL.D. 1935
Physicist, Director, National Bureau of Standards. 3208 Newark Street, Cleveland Park, Washington, D. C.

Bronk, Detlev W., M.S., Ph.D., Sc.D. 1934
Physiologist, Professor of Physiology, Cornell University Medical College, 1300 York Avenue, New York, N. Y.

Brooke, C. F. Tucker, M.A., B.Litt., Litt.D. 1938
Sterling Professor of English, Yale University. 88 Cold Spring Street, New Haven, Conn.

Date of Election

Brooks, Van Wyck, Litt.D. 1939
Author and Literary Historian. Westport, Conn.

Brubaker, Albert P., A.M., M.D., LL.D. 1895
Professor Emeritus of Physiology, Jefferson Medical College. 109 North 34th Street, Philadelphia, Pa.

Bryant, William L. 1935
Paleontologist, Director, Park Museum, Providence, R. I.

Buck, Carl Darling, A.B., Ph.D., Litt.D. 1923
Professor Emeritus of Comparative Philology, University of Chicago, Chicago, Ill.

Buddington, Arthur F., Ph.B., M.S., Ph.D. 1931
Professor of Geology, Chairman, Department of Geology, Princeton University, Princeton, N. J.

Bumpus, Hermon Carey, Ph.D., Sc.D., LL.D. 1909
Zoologist, Educator (ret.), Formerly Director, American Museum of Natural History. Duxbury, Mass.

Bush, Vannevar, Sc.D., Eng.D., LL.D. 1937
Engineer, President, Carnegie Institution of Washington, Washington, D. C.

Butler, Nicholas Murray, Ph.D., LL.D. 1938
President, Columbia University, New York, N. Y.

Byrd, Richard Evelyn, D.Eng., Sc.D., LL.D. 1930
Geographer, Navigator, Rear-Admiral (ret.), United States Navy. 9 Brimmer Street, Boston, Mass.

Calvert, Philip Powell, Ph.D. 1918
Professor Emeritus of Zoology, University of Pennsylvania. P. O. Box 14, Cheyney, Pa.

Campbell, Douglas Houghton, Ph.D., LL.D. 1910
Professor Emeritus of Botany, Stanford University, Calif.

Cannon, Annie J., B.S., M.A., Sc.D., LL.D. 1925
Astronomer, Curator of Astronomical Photographs, Harvard College Observatory, Cambridge, Mass.

Cannon, Walter Bradford, A.M., M.D., Sc.D., LL.D., Dr. (hon.) 1908
George Higginson Professor of Physiology, Harvard Medical School, Boston, Mass.

Date of Election

Capps, Edward, Ph.D., LL.D., Litt.D., L.H.D. 1920
Professor Emeritus of Classics, Princeton University,
Princeton, N. J.

Carlson, Anton Julius, A.M., Ph.D., M.D., LL.D. 1928
Professor of Physiology, University of Chicago.
5228 Greenwood Avenue, Chicago, Ill.

Carpenter, Rhys, Ph.D. 1935
Professor of Archaeology, Bryn Mawr College.
Jerry Run, R.D. 2, Downingtown, Pa.

Carrel, Alexis, M.D., Sc.D., LL.D. 1909
Surgeon, Biologist, Member Emeritus, Rockefeller
Institute for Medical Research, 66th Street and
York Avenue, New York, N. Y.

Case, Ermine Cowles, A.B., A.M., M.S., Ph.D. 1931
Chairman, Department of Geology, Director and Curator
of Vertebrates, Museum of Paleontology, University of
Michigan, Ann Arbor, Mich.

Castle, William Bosworth, M.D. 1939
Professor of Medicine, Harvard Medical School;
Associate Director, Thorndike Memorial Laboratory and
Director, Second and Fourth Medical Services
(Harvard), Boston City Hospital, Boston, Mass.

Castle, William Ernest, A.M., Ph.D., Sc.D., LL.D. 1910
Professor Emeritus of Genetics, Harvard University;
Research Associate in Genetics, University of California,
Hilgard Hall, Berkeley, Calif.

Cather, Willa, Litt.D., LL.D. 1934
Author. Care A. A. Knopf, 501 Madison Avenue,
New York, N. Y.

Cattell, James McKeen, Ph.D., LL.D., D.H.L., Sc.D. 1888
Psychologist, Editor. Garrison, N. Y.

Chamberlain, Joseph Perkins, Ph.D., LL.D. 1940
Professor of Public Law, Columbia University.
8 Sutton Square, New York, N. Y.

Chapman, Frank Michler, Sc.D. 1921
Curator in Ornithology, American Museum of
Natural History, New York, N. Y.

Date of Election

Chase, George Henry, A.B., A.M., Ph.D., L.H.D., Litt.D. 1929
Professor of Archaeology, Dean of the University, Harvard University. 1 Bryant Street, Cambridge, Mass.

Cheyney, Edward Potts, A.M., Litt.D., LL.D. 1904
Professor Emeritus of European History, University of Pennsylvania. R.F.D. 3, Media, Pa.

Chinard, Gilbert, B.L., L.èsL., LL.D. 1932
Professor of French Literature, Princeton University. 93 Mercer Street, Princeton, N. J.

Chittenden, Russell H., Ph.D., LL.D., Sc.D., M.D. (hon.) 1904
Professor Emeritus of Physiological Chemistry, Director Emeritus, Sheffield Scientific School, Yale University. 83 Trumbull Street, New Haven, Conn.

Clark, William Mansfield, Ph.D., Sc.D. 1939
De Lamar Professor of Physiological Chemistry, Johns Hopkins University, School of Medicine, Baltimore, Md.

Cleland, Ralph Erskine, A.B., M.S., Ph.D. 1932
Professor and Head, Department of Botany and Bacteriology, Indiana University, Bloomington, Ind.

Coble, Arthur Byron, Ph.D., LL.D. 1939
Professor of Mathematics, University of Illinois. 702 W. Washington Boulevard, Urbana, Ill.

Cockerell, Theodore Dru Alison, D.Sc. 1928
Professor Emeritus of Zoology, University of Colorado. 908 10th Street, Boulder, Colo.

Coghill, George Ellett, Ph.D., Sc.D. 1935
Anatomist. Box 77A, R.F.D. 2, Gainesville, Fla.

Commons, John Rogers, LL.D. 1936
Professor of Economics (ret.), University of Wisconsin. P. O. 1498, Ft. Lauderdale, Fla.

Compton, Arthur Holly, B.Sc., Ph.D., Sc.D., LL.D. 1925
Professor of Physics, University of Chicago. 5637 Woodlawn Avenue, Chicago, Ill.

Compton, Karl Taylor, Ph.D., Sc.D., D.Eng., LL.D. 1923
Physicist, President, Massachusetts Institute of Technology, Cambridge, Mass.

Date of Election

Conant, James Bryant, Ph.D., LL.D. 1935
Chemist, President, Harvard University.
17 Quincy Street, Cambridge, Mass.

Conklin, Edwin Grant, Ph.D., Sc.D., LL.D. 1897
Professor Emeritus of Biology, Princeton University,
Princeton, N. J.

Coolidge, William David, Ph.D., Sc.D. 1938
Physicist, Director, Research Laboratories of the General
Electric Company. 1480 Lenox Road, Schenectady, N. Y.

Corner, George Washington, M.D. 1940
Director, Department of Embryology, Carnegie
Institution of Washington, Wolfe and Madison Streets,
Baltimore, Md.

Corwin, Edward Samuel, Ph.D., LL.D., Litt.D. 1936
Professor of Jurisprudence, Princeton University,
Princeton, N. J.

Cottrell, Frederick Gardner, Ph.D., LL.D. 1938
Chemist, Consultant to Research Corporation, New York.
3904 Ingomar Street, N.W., Washington, D. C.

Cret, Paul Philippe, Sc.D., N.A. 1928
Architect, Architects Building, Philadelphia, Pa.

Crew, Henry, Ph.D. 1921
Professor Emeritus of Physics, Northwestern University.
620 Library Place, Evanston, Ill.

Crile, George, A.M., M.D., LL.D. 1912
Surgeon, Director, Cleveland Clinic Foundation,
Euclid Avenue at East 93rd Street, Cleveland, Ohio.

Crocker, William, A.B., A.M., Ph.D. 1931
Botanist, Managing Director, Boyce Thompson Institute
for Plant Research, Inc. 1086 North Broadway,
Yonkers, N. Y.

Cross, Whitman, B.S., Ph.D., Sc.D. 1915
Geologist, United States Geological Survey (ret.).
101 East Kirke Street, Chevy Chase, Md.

Cross, Wilbur L., A.B., Ph.D., Litt.D., L.H.D., LL.D. 1934
Governor of Connecticut (1932–38); Professor
Emeritus of English, Yale University; Editor of
The Yale Review. 24 Edgehill Road, New Haven, Conn.

	Date of Election
Curtis, Heber Doust, A.M., Ph.D., Sc.D. Astronomer, Director, The Observatory, University of Michigan, Ann Arbor, Mich.	1920
Dahlgren, Ulric, A.B., M.S. Professor Emeritus of Biology, Princeton University. 7 Evelyn Place, Princeton, N. J.	1919
Daly, Reginald Aldworth, A.M., Ph.D., Sc.D. Professor of Geology, Harvard University. 23 Hawthorn Street, Cambridge, Mass.	1913
Damrosch, Walter Johannes, Mus.D. Musician, Conductor. 168 East 71st Street, New York, N. Y.	1939
Darrach, William, A.B., A.M., M.D., Sc.D., LL.D. Professor of Clinical Surgery, Dean Emeritus of the Medical Faculty, Columbia University. 180 Fort Washington Avenue, New York, N. Y.	1929
Darrow, Karl Kelchner, Ph.D. Research Physicist, Bell Telephone Laboratories. 230 West 105th Street, New York, N. Y.	1936
Davenport, Charles Benedict, Ph.D. Biologist. Cold Spring Harbor, Long Island, N. Y.	1907
Davis, Bradley Moore, A.M., Ph.D. Professor of Botany, University of Michigan, Ann Arbor, Mich.	1914
Davis, Harvey Nathaniel, Ph.D., Sc.D., LL.D., D.Eng. Mechanical Engineer, President, Stevens Institute of Technology. Hoxie House, Castle Point, Hoboken, N. J.	1935
Davis, John William, A.B., LL.B., LL.D. Lawyer, United States Solicitor General (1913–18); United States Ambassador to Great Britain (1918–21). 15 Broad Street, New York, N. Y.	1923
Davisson, Clinton J., Ph.D., D.Sc. Physicist, Bell Telephone Laboratories, 463 West Street, New York, N. Y.	1929
Day, Arthur L., Ph.D., Sc.D. Geophysicist, Director (ret.), Geophysical Laboratory (1907–36), Carnegie Institution of Washington. 1565 Old Georgetown Road, Bethesda, Md.	1912

Date of Election

Day, Edmund Ezra, Ph.D., LL.D. 1937
President, Cornell University, Ithaca, N. Y.

Delano, Frederic Adrian 1935
Administrator (ret.); Vice-chairman, National Resources Committee since 1933. 2400 16th Street, Washington, D. C.

Dempster, Arthur Jeffrey, A.B., A.M., Ph.D., Sc.D. 1932
Professor of Physics, University of Chicago. 5757 Kenwood Avenue, Chicago, Ill.

Derleth, Charles, Jr., C.E., LL.D. 1936
Engineer, Dean, College of Engineering, University of California, Berkeley, Calif.

Detwiler, Samuel Randall, Ph.D. 1940
Professor of Anatomy, Columbia University, New York, N. Y.

Dewey, John, A.B., Ph.D., LL.D. 1911
Professor Emeritus of Philosophy, Columbia University. 1 West 89th Street, New York, N. Y.

Dickinson, John, Ph.D., LL.B., LL.D. 1940
Professor of Law, University of Pennsylvania; Counsel of the Pennsylvania Railroad. Broad Street Station Building, Philadelphia, Pa.

Dinsmoor, William Bell, Litt.D. 1933
Professor of Archaeology, Columbia University. 9 East 77th Street, New York, N. Y.

Dodds, Harold Willis, Ph.D., LL.D. 1935
Administrator, President, Princeton University, Princeton, N. J.

Dresden, Arnold, M.S., Ph.D. 1932
Professor of Mathematics, Swarthmore College. 606 Elm Avenue, Swarthmore, Pa.

Duane, Morris, A.B., LL.B. 1940
Partner, Duane, Morris and Heckscher Law Offices. Wakefield Road, Rosemont, Pa.

DuBois, Eugene Floyd, M.D. 1940
Professor of Medicine, Cornell University Medical College; Physician-in-Chief, New York Hospital. 525 East 68th Street, New York, N. Y.

Date of Election

Duggar, Benjamin Minge, A.M., Ph.D. 1921
Professor of Plant Physiology and Economic Botany, University of Wisconsin, Madison, Wis.

Dunn, Gano, M.S., E.E., D.Sc. 1924
Engineer, President, J. G. White Engineering Corporation; President, Cooper Union for the Advancement of Science and Art. 80 Broad Street, New York, N. Y.

Du Pont, Francis I. 1930
Chemist. P. O. Box 847, Wilmington, Del.

Du Pont, Pierre Samuel, B.S. 1917
Chemist, Manufacturer, E. I. du Pont de Nemours and Company. Du Pont Building, Wilmington, Del.

Durand, William Frederick, Ph.D., LL.D. 1917
Professor Emeritus of Mechanical Engineering, Stanford University, Calif.

Edgerton, Franklin, Ph.D. 1935
Professor of Sanskrit and Comparative Philology, Yale University. 174 Blake Road, Hamden, New Haven, Conn.

Einstein, Albert, Ph.D., M.D. 1930
Professor of Theoretical Physics, Institute for Advanced Study, Princeton, N. J.

Eisenhart, Luther Pfahler, A.B., Ph.D., Sc.D., LL.D. 1913
Professor of Mathematics, Dean, Graduate School, Princeton University. Wyman House, Princeton, N. J.

Emmet, William LeRoy, Sc.D. 1898
Consulting Engineer, General Electric Company, Schenectady, N. Y.

Erlanger, Joseph, B.S., M.D., LL.D., Sc.D. 1927
Professor of Physiology, Washington University. 4580 Scott Avenue, St. Louis, Mo.

Farrand, Max, Ph.D., LL.D., L.H.D. 1928
Historian, Director, Huntington Library and Art Gallery, San Marino, Calif.

Fels, Samuel S., LL.D. 1939
President, Fels and Company, Paschall Oxygen Company. 39th and Walnut Streets, Philadelphia, Pa.

Date of Election

Ferguson, William Scott, A.M., Ph.D., LL.D., Litt.D. 1937
MacLean Professor of Ancient and Modern History, Dean, Faculty of Arts and Sciences, Harvard University. 8 Scott Street, Cambridge, Mass.

Fermi, Enrico, Ph.D. 1939
Professor of Physics, Columbia University, New York, N. Y.

Fernald, Merritt Lyndon, S.B., D.C.L., D.Sc. 1936
Professor of Natural History, Director, Gray Herbarium, Harvard University, Cambridge, Mass.

Fetter, Frank Albert, Ph.D., LL.D. 1935
Professor Emeritus of Political Economy, Princeton University. 168 Prospect Avenue, Princeton, N. J.

Fisher, Irving, Ph.D., LL.D. 1927
Professor Emeritus of Economics, Yale University. Box 1825, New Haven, Conn.

Flexner, Simon, M.D., Sc.D., LL.D. 1901
Pathologist, Director Emeritus, Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York, N. Y.

Foote, Paul Darwin, A.B., M.A., Ph.D. 1927
Physicist, Executive Vice-president, Gulf Research and Development Company. P.O. Drawer 2038, Pittsburgh, Pa.

Forbes, Alexander, A.B., A.M., M.D. 1931
Professor of Physiology, Harvard Medical School, Shattuck Street, Boston, Mass.

Ford, Guy Stanton, Ph.D., Litt.D., LL.D. 1939
Historian, President, University of Minnesota. 517 Essex Street, Minneapolis, Minn.

†Ford, Worthington Chauncey, A.M., Litt.D., LL.D. 1922
Historian, Statistician. 7 boulv. Carnot, Le Cannet, Alpes Maritimes, France.

Fosdick, Raymond Blaine, B.A., M.A., LL.B., LL.D. 1930
Lawyer, President, Rockefeller Foundation and General Education Board, 49 West 49th Street, New York, N. Y.

† Deceased March 7, 1941.

Date of Election

Fox, Dixon Ryan, Ph.D., Pd.D., L.H.D., Litt.D., LL.D., D.C.L. 1935
Historian, President, Union College, Schenectady, N. Y.

Fox, Herbert, A.B., M.D. 1932
Pathologist to the Philadelphia Zoological Society; Professor of Comparative Pathology, University of Pennsylvania; Director, William Pepper Laboratory, Hospital of the University of Pennsylvania, Philadelphia, Pa.

Franck, James, Ph.D., LL.D. 1937
Professor of Physical Chemistry, University of Chicago, Chicago, Ill.

Frankfurter, Felix, LL.B. 1939
Associate Justice, Supreme Court of the United States, Washington, D. C.

Frost, Robert, L.H.D., Litt.D. 1937
Poet, Professor of English, Amherst College. South Shaftsbury, Vt.

Gaposchkin, Cecilia Payne, B.A., Ph.D. 1936
Astronomer, Harvard College Observatory, Cambridge, Mass.

Gasser, Herbert Spencer, A.M., M.D., Sc.D. 1937
Physiologist, Director, Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York, N. Y.

Gates, Thomas Sovereign, Ph.B., LL.B., LL.D. 1930
Administrator, President, University of Pennsylvania, Philadelphia, Pa.

Gay, Edwin Francis, A.B., Ph.D., Litt.D., LL.D. 1932
Professor Emeritus of Economic History, Harvard University. 2040 Pasqual Street, Pasadena, Calif.

Giauque, William Francis, Ph.D., Sc.D. 1940
Professor of Chemistry, University of California, Berkeley, Calif.

Gies, William J., B.S., Ph.B., M.S., Ph.D., Sc.D., LL.D. 1915
Professor of Biological Chemistry, Columbia University Medical School. 630 West 168th Street, New York, N. Y.

Date of Election

Gifford, Walter Sherman, A.B., LL.D., D.Sc., D.C.L. 1931
Administrator, President, American Telephone and Telegraph Company. 195 Broadway, New York, N. Y.

Gomberg, Moses, B.S., Sc.D., LL.D. 1920
Professor Emeritus of Chemistry, University of Michigan. 712 Onondaga Street, Ann Arbor, Mich.

Goodrich, Herbert Funk, A.B., LL.B., LL.D. 1937
Dean, Law School, Professor of Law, Vice-president, University of Pennsylvania. 7701 Cresheim Road, Chestnut Hill, Philadelphia, Pa.

Goodspeed, Arthur Willis, A.B., Ph.D. 1896
Professor Emeritus of Physics, University of Pennsylvania. 4304 Chestnut Street, Philadelphia, Pa.

Graves, Frank Pierrepont, A.M., Ph.D., Litt.D., L.H.D., LL.D., D.C.L. 1927
Educator, President, University of the State of New York; Commissioner of Education, State Education Building, Albany, N. Y.

Greene, Evarts B., Ph.D., Litt.D., L.H.D., LL.D. 1931
Professor Emeritus of American History, Columbia University. Box 194, Croton-on-Hudson, N. Y.

Gregory, Herbert Ernest, Ph.D., D.Sc. 1923
Silliman Professor Emeritus of Geology, Yale University; Director Emeritus, Bernice P. Bishop Museum, Honolulu, Hawaii.

Gregory, William King, A.M., Ph.D., D.Sc. 1925
Professor of Vertebrate Paleontology, Columbia University; Curator, Department of Comparative Anatomy, Department of Ichthyology, American Museum of Natural History, New York, N. Y.

Griffith, J. P. Crozer, A.B., M.D., Ph.D. 1907
Physician, Professor Emeritus of Pediatrics, University of Pennsylvania. 1810 Spruce Street, Philadelphia, Pa.

Guggenheim, William, B.S. 1930
Industrialist, Administrator, Philanthropist. 3 Riverside Drive, New York, N. Y.

Gulick, Charles Burton, Ph.D. 1940
Eliot Professor Emeritus of Greek Literature, Harvard University. 59 Fayerweather Street, Cambridge, Mass.

Date of Election

Haney, John Louis, A.B., A.M., B.S., Ph.D., LL.D. 1929
Educator, President, Central High School of Philadelphia. 6419 Woodbine Avenue, Overbrook, Philadelphia, Pa.

Harkins, William Draper, A.B., Ph.D. 1925
Professor of Physical Chemistry, University of Chicago. 5437 Ellis Avenue, Chicago, Ill.

Harper, Robert A., M.A., Ph.D., D.Sc. 1909
Professor Emeritus of Botany, Columbia University, New York, N. Y.

Harrison, Ross G., M.A., Ph.D., M.D., Sc.D. 1913
Professor Emeritus of Biology, Yale University; Chairman, National Research Council. 142 Huntington Street, New Haven, Conn.

Harvey, E. Newton, Ph.D. 1929
Henry Fairfield Osborn Professor of Biology, Princeton University, Princeton, N. J.

Hawk, Philip Bovier, M.S., Ph.D. 1915
Chemist, President and Director, Food Research Laboratories, Inc., of New York. 48–14 Thirty-Third Street, Long Island City, N. Y.

Hayes, Carlton Joseph Huntley, Ph.D., Litt.D., LL.D., L.H.D. 1940
Seth Low Professor of History, Columbia University. 427 West 117th Street, New York, N. Y.

Hayward, Nathan, A.B., S.B. 1937
President (ret.), The Franklin Institute. 12 South Twelfth Street, Philadelphia, Pa.

Hazen, Charles D., A.B., Ph.D., L.H.D., Litt.D. 1923
Professor of History, Columbia University, New York, N. Y.

Heiser, Victor George, A.B., M.D., Sc.D., LL.D. 1918
Physician (ret.). Bantam, Conn.

Henderson, Lawrence J., M.D., Sc.D., Dr.(hon.) 1921
Abbott and James Lawrence Professor of Chemistry, Harvard University. 4 Willard Street, Cambridge, Mass.

Henderson, Robert, B.A., D.Sc. 1927
Mathematician, Actuarial Consultant. Crown Point, Essex County, N. Y.

Date of Election

Henderson, Yandell, Ph.D. 1935
Professor Emeritus of Physiology, Yale University.
440 Prospect Street, New Haven, Conn.

Hendrickson, George Lincoln, A.B., L.H.D. 1932
Professor of Greek and Latin Literature,
851 Branford College, Yale University, New Haven, Conn.

Hisaw, Frederick, Ph.D., LL.D. 1940
Professor of Zoology, Harvard University,
Cambridge, Mass.

Hobbs, William Herbert, A.M., Ph.D., D.Eng., LL.D. 1909
Professor Emeritus of Geology, University of Michigan,
Ann Arbor, Mich.

Holland, Leicester Bodine, B.S., M.A., Ph.D., F.A.I.A. 1931
Archaeologist, Professor of Fine Arts, University of
Pennsylvania; Chief, Division of Fine Arts, Library of
Congress. 4203 Pine Street, Philadelphia, Pa.

Hooton, Earnest A., B.A., M.A., Ph.D., B.Litt., Sc.D. 1931
Professor of Anthropology, Curator of Somatology,
Peabody Museum, Harvard University, Cambridge, Mass.

Hoover, Herbert, Dr. Eng., M.D., Sc.D., LL.D., D.C.L., J.D. 1918
Engineer, Thirty-first President of the United States.
Stanford University, Calif.

Hopkins, B Smith, Ph.D., D.Sc., LL.D. 1927
Professor of Inorganic Chemistry, University of
Illinois, Urbana, Ill.

Hopkinson, Edward, Jr., A.B., LL.B. 1938
Lawyer, Banker, Trustee, University of Pennsylvania.
8700 Montgomery Avenue, Chestnut Hill,
Philadelphia, Pa.

Howard, Leland Ossian, M.D., Ph.D., Sc.D., LL.D. 1911
Zoologist, Consulting Entomologist, United States
Public Health Service. Bureau of Entomology,
United States Department of Agriculture,
Washington, D. C.

Howell, William Henry, A.B., Ph.D., M.D., Sc.D., LL.D. 1903
Professor Emeritus of Physiology, Formerly Dean,
Medical Faculty and Director, School of Hygiene,
Johns Hopkins University. 112 St. Dunstan's Road,
Baltimore, Md.

	Date of Election
Hrdlička, Aleš, M.D., Sc.D. Curator, Division of Physical Anthropology, United States National Museum, Washington, D. C.	1918
Hubble, Edwin P., B.Sc., Ph.D., B.A., D.Sc., LL.D. Astronomer, Mount Wilson Observatory, Pasadena, Calif.	1929
Huebner, Solomon Stephen, Ph.D., Sc.D. Economist, Professor of Insurance and Commerce, University of Pennsylvania; President, American College of Life Underwriters. 697 South Highland Avenue, Merion, Pa.	1930
Hughes, Charles Evans, A.B., A.M., LL.B., LL.D., D.C.L. Chief Justice of the United States. 2223 R Street, N.W., Washington, D. C.	1926
Hulett, George A., A.B., Ph.D. Professor Emeritus of Physical Chemistry, Princeton University. 44 Washington Road, Princeton, N. J.	1913
Humphreys, William Jackson, A.B., C.E., Ph.D. Professor Emeritus of Meteorological Physics, George Washington University; Collaborator, United States Weather Bureau, Washington, D. C.	1929
Hunsaker, Jerome Clarke, D.Sc. Head, Department of Mechanical Engineering, Massachusetts Institute of Technology; Professor in Charge, Guggenheim Aeronautical Laboratory. 10 Louisburg Square, Boston, Mass.	1940
Huntington, Edward Vermilye, A.B., A.M., Ph.D., Sc.D. Mathematician, Professor of Mechanics, Harvard University. 48 Highland Street, Cambridge, Mass.	1933
Ives, Herbert E., B.S., Ph.D., Sc.D. Physicist, Bell Telephone Laboratories. 32 Laurel Place, Montclair, N. J.	1917
Jackson, Dugald Caleb, C.E., D.Sc., D.Eng. Professor Emeritus of Electrical Engineering, Massachusetts Institute of Technology. 5 Mercer Circle, Cambridge, Mass.	1931
Jacobs, Merkel Henry, A.B., Ph.D. Professor of General Physiology, University of Pennsylvania, Philadelphia, Pa.	1930

Date of Election

Jayne, Horace Howard Furness, A.B., A.M. 1934
Archaeologist, Vice-director, Metropolitan Museum of Art. 151 East 83d Street, New York, N. Y.

Jenks, John Story, M.A. 1936
Banker, Trustee, President, University Museum, University of Pennsylvania. 123 South Broad Street, Philadelphia, Pa.

Jennings, Herbert S., Ph.D., Sc.D., LL.D. 1907
Professor Emeritus of Zoology, Johns Hopkins University; Research Associate, University of California, Los Angeles, Calif.

Jessup, Philip C., LL.B., LL.D., Ph.D. 1939
Professor of International Law, Columbia University, New York, N. Y.

Jewett, Frank Baldwin, A.B., Ph.D., D.Sc., D.Eng., LL.D. 1938
Vice-president, American Telephone and Telegraph Company; Chairman of the Board, Bell Telephone Laboratories, Inc. 195 Broadway, New York, N. Y.

Johnson, Douglas, Ph.D., D.Sc. 1920
Geologist and Geographer, Professor of Physiography, Columbia University, New York, N. Y.

Johnson, Eldridge Reeves, A.E.D. 1928
Industrialist, Founder, Victor Talking Machine Company. 608 West Jersey Trust Building, Camden, N. J.

Johnson, Emory R., Litt.M., Ph.D., Sc.D. 1915
Professor Emeritus of Transportation and Commerce, Logan Hall, University of Pennsylvania, Philadelphia, Pa.

Jones, Lewis Ralph, Ph.B., Ph.D., Sc.D., LL.D. 1925
Professor Emeritus of Plant Pathology, University of Wisconsin, Madison, Wis.

Joslin, Elliott Proctor, B.A., M.A., Ph.B., M.D. 1925
Physician, Clinical Professor Emeritus of Medicine, Harvard Medical School. 81 Bay State Road, Boston, Mass.

Kemmerer, Edwin Walter, A.B., Ph.D., LL.D., D.C.S., D.Sc. 1932
Political Economist, Walker Professor of International Finance, Princeton University, Princeton, N. J.

	Date of Election
Keppel, Frederick Paul, Litt.D., LL.D. President, Carnegie Corporation of New York, 522 Fifth Avenue, New York, N. Y.	1938
Kettering, Charles Franklin, M.E., E.E., D.Eng., D.Sc. Research Engineer, Vice-president, General Motors Corporation; General Director, Research Laboratories Division, General Motors Corporation. Ridgeleigh Terrace, Dayton, Ohio.	1930
Keyes, Frederick George, M.S., Ph.D., D.Sc. Professor and Head, Department of Chemistry, Massachusetts Institute of Technology. 15 Berkeley Street, Cambridge, Mass.	1938
Kidder, Alfred Vincent, Ph.D., LL.D. Archaeologist, Chairman, Division of Historical Research, Carnegie Institution of Washington. 10 Frisbie Place, Cambridge, Mass.	1934
Kistiakowsky, George Bogdan, Ph.D. Professor of Chemistry, Harvard University. 12 Oxford Street, Cambridge, Mass.	1940
Kofoid, Charles A., A.M., Ph.D., Sc.D., LL.D. Professor Emeritus of Zoology, University of California, Berkeley, Calif.	1924
Köhler, Wolfgang, Ph.D. Professor of Psychology, Swarthmore College. 603 Elm Avenue, Swarthmore, Pa.	1939
Kraus, Charles August, Ph.D. Professor of Chemistry and Director of Research in Chemistry, Brown University. 92 Keene Street, Providence, R. I.	1939
Lamb, Arthur Becket, Ph.D., D.Sc. Professor of Chemistry, Dean, Graduate School of Arts and Sciences, Harvard University. 12 Oxford Street, Cambridge Mass.	1936
Lamont, Thomas William, A.B., LL.D. Banker, Trustee. 23 Wall Street, New York, N. Y.	1932
Lampland, Carl O., A.B., A.M., LL.D. Astronomer, Lowell Observatory, Flagstaff, Ariz.	1931

	Date of Election
Lancaster, Henry Carrington, M.A., Ph.D. Professor of French Literature, Chairman, Department of Romance Languages, Johns Hopkins University. 604 Edgevale Road, Baltimore, Md.	1938
Landsteiner, Karl, M.D., D.Sc. Pathologist, Rockefeller Institute for Medical Research. 25 East 86th Street, New York, N. Y.	1935
Langmuir, Irving, M.A., Ph.D., Sc.D., LL.D. Chemist and Physicist, Associate Director, Research Laboratory, General Electric Company, Schenectady, N. Y.	1922
†Lanman, Charles R., A.B., Ph.D., LL.D. Professor Emeritus of Sanskrit, Harvard University. 9 Farrar Street, Cambridge, Mass.	1906
Lashley, Karl Spencer, M.S., Ph.D., Sc.D. Research Professor of Neuropsychology, Harvard University, Cambridge, Mass.	1938
Lawrence, Ernest Orlando, B.S., A.M., Ph.D., Sc.D., LL.D. Professor of Physics, Director, Radiation Laboratory, University of California, Berkeley, Calif.	1937
Lawson, Andrew Cowper, M.A., Ph.D., Sc.D., LL.D. Professor of Mineralogy and Geology (ret.), University of California, Berkeley, Calif.	1925
Leeds, Morris Evans, D.Eng. Chairman of the Board, Leeds and Northrup Company. 1025 Westview Street, Philadelphia, Pa.	1940
Lefschetz, Solomon, M.E., Ph.D. Research Professor of Mathematics, Princeton University. 129 Broadmead, Princeton, N. J.	1929
Leith, Charles Kenneth, B.S., Ph.D., LL.D., D.Sc. Professor of Geology, University of Wisconsin. Moraine, Old Sauk Road, Madison, Wis.	1926
Leland, Waldo G., A.B., A.M., Litt.D., L.H.D. Historian, Director, American Council of Learned Societies. 907 Fifteenth Street, Washington, D. C.	1931

† Deceased February 20, 1941.

	Date of Election
Leuschner, Armin Otto, A.B., Ph.D., Sc.D., LL.D. Professor of Astronomy, Director Emeritus, Students' Observatory, University of California. 1816 Scenic Avenue, Berkeley, Calif.	1924
Leverett, Frank, B.Sc., Sc.D. Geologist (ret.), United States Geological Survey. 1724 South University Avenue, Ann Arbor, Mich.	1924
Lewis, Gilbert Newton, A.B., A.M., Ph.D., D.Sc. Professor of Chemistry, Dean, College of Chemistry, University of California, Berkeley, Calif.	1918
Lillie, Frank Rattray, B.A., Ph.D., Sc.D. Andrew MacLeish Distinguished Service Professor Emeritus of Embryology, University of Chicago. 5801 Kenwood Avenue, Chicago, Ill.	1916
Lillie, Ralph Stayner, B.A., Ph.D., Sc.D. Professor of General Physiology, University of Chicago. 5545 Kenwood Avenue, Chicago, Ill.	1937
Lingelbach, William E., B.A., Ph.D., Litt.D. Dean of the College, Professor of Modern European History, University of Pennsylvania. 4304 Osage Avenue, Philadelphia, Pa.	1916
Livingston, Burton E., B.S., Ph.D. Professor of Plant Physiology and Forest Ecology, Director, Laboratory of Plant Physiology, Johns Hopkins University. Riderwood, Md.	1933
Loeb, Leo, M.D. Professor Emeritus and Research Professor of Pathology, Washington University Medical School, St. Louis, Mo.	1910
Long, Esmond Ray, Ph.D., M.D. Director, Henry Phipps Institute, Professor of Pathology, University of Pennsylvania; President, Wistar Institute. Henry Phipps Institute, Seventh and Lombard Streets, Philadelphia, Pa.	1940
Loomis, Alfred Lee, A.B., LL.B., D.Sc., M.Sc. Physicist, Director, Loomis Laboratories. Tuxedo Park, N. Y.	1930

Date of Election

Lovejoy, Arthur Oncken, A.B., A.M., LL.D. 1932
Professor of Philosophy, Johns Hopkins University.
827 Park Avenue, Baltimore, Md.

Lovett, Edgar Odell, Ph.D., Sc.D., LL.D. 1904
Mathematician and Astronomer,
President, The Rice Institute, Houston, Texas.

Lowell, Abbott Lawrence, A.B., LL.B., Ph.D., Litt.D., LL.D. 1909
President Emeritus, Harvard University.
171 Marlborough Street, Boston, Mass.

Lowes, John Livingston, Ph.D., LL.D., Litt.D., L.H.D. 1934
Francis Lee Higginson Professor Emeritus of English Literature, Harvard University. 984 Memorial Drive, Cambridge, Mass.

Lydenberg, Harry Miller, L.H.D., Litt.D. 1939
Director, New York Public Library.
23 Park Road, Scarsdale, N. Y.

Lyman, Theodore, A.M., Ph.D. 1918
Professor Emeritus of Physics, Director, Jefferson Laboratory, Harvard University, Cambridge, Mass.

McClung, Clarence E., Ph.G., A.B., A.M., Ph.D., Sc.D. 1913
Professor Emeritus of Zoology, University of Pennsylvania; Visiting Professor of Zoology, University of Illinois, Urbana, Ill.

McClure, Charles Freeman Williams, A.B., A.M., Sc.D. 1897
Professor Emeritus of Comparative Anatomy, Princeton University. 1 Battle Road, Princeton, N. J.

MacCurdy, George Grant, A.B., A.M., Ph.D. 1925
Professor Emeritus of Anthropology, Yale University; Director, American School of Prehistoric Research, Old Lyme, Conn.

McDaniel, Walton Brooks, A.B., A.M., Ph.D. 1917
Professor Emeritus of Latin Language and Literature, University of Pennsylvania. 4082 Malaga Avenue, Coconut Grove, Fla.

MacDougal, Daniel Trembly, M.A., Ph.D., LL.D. 1916
Director (ret.), Laboratory for Plant Physiology, Carnegie Institution of Washington. Carmel, Calif.

	Date of Election
Macfarlane, John Muirhead, B.S., Sc.D., LL.D., Litt.D. Professor Emeritus of Botany, University of Pennsylvania. 427 West Hansberry Street, Germantown, Philadelphia, Pa.	1892
MacNider, William de Berniere, M.D., Sc.D., LL.D. Kenan Research Professor of Pharmacology, University of North Carolina, Chapel Hill, N. C.	1939
McGregor, James Howard, B.S., M.A., Ph.D. Professor of Zoology, Columbia University, New York, N. Y.	1929
McIlwain, Charles Howard, A.M., Ph.D., LL.D. Eaton Professor of the Science of Government, Harvard University. 48 Village Hill Road, Belmont, Mass.	1938
Magie, William Francis, A.M., Ph.D., LL.D., D.Sc. Professor Emeritus of Physics, Princeton University. 118 Library Place, Princeton, N. J.	1896
Mark, Edward Laurens, A.M., Ph.D., LL.D. Professor Emeritus of Anatomy, Harvard University. 109 Irving Street, Cambridge, Mass.	1907
Mason, William Smith, Ph.B., A.M., L.H.D., D.Litt. Man of Affairs, Collector of Frankliniana, University Trustee. 1401 Ridge Avenue, Evanston, Ill.	1928
Mather, Frank Jewett, Jr., Ph.D., L.H.D. Professor Emeritus of Art and Archaeology, Princeton University. Washington Crossing, Pa.	1940
Matthews, Albert, A.B. Modern Philologist and Historian. 19 St. Botolph Street, Boston, Mass.	1899
Mees, Charles Edward Kenneth, D.Sc. Chemist, Vice-president in Charge of Research and Development, Eastman Kodak Company, Rochester, N. Y.	1937
Meritt, Benjamin Dean, Ph.D., D.Litt., LL.D. Professor of Greek Epigraphy, Institute for Advanced Study, Princeton, N. J.	1938
Merriam, Charles Edward, Ph.D., LL.D. Professor of Political Science, University of Chicago. 6041 University Avenue, Chicago, Ill.	1935

Date of Election

Merriam, John C., B.S., Ph.D., Sc.D., LL.D. 1914
Paleontologist, President Emeritus, Carnegie Institution of Washington, Washington, D. C.

Merrill, Elmer Drew, B.S., M.S., Sc.D., LL.D. 1932
Professor of Botany, Administrator of Botanical Collections, Harvard University. Arnold Arboretum, Jamaica Plain, Mass.

Merrill, Paul Willard, Ph.D. 1939
Astronomer, Mount Wilson Observatory, Carnegie Institution of Washington, Pasadena, Calif.

†Miller, Dayton Clarence, Sc.D., LL.D., D.Eng. 1919
Honorary Professor of Physics, Case School of Applied Science, Cleveland, Ohio.

Miller, Gerrit Smith, Jr., A.B. 1927
Zoologist, Curator of Mammals, United States National Museum, Washington, D. C.

Miller, Hunter, LL.B., LL.M., D.C.L. 1928
International Law, Editor of *The Treaties*, Department of State. Craiglands, R. M. D. 1, Victoria, B. C., Canada.

Miller, John Anthony, A.M., Ph.D., LL.D. 1915
Professor Emeritus of Astronomy, Director Emeritus, Sproul Observatory, Swarthmore College. Wallingford, Pa.

Millikan, Robert Andrews, Ph.D., LL.D., Sc.D. 1914
Director, Norman Bridge Laboratory of Physics, Chairman, Executive Council, California Institute of Technology, Pasadena, Calif.

Minot, George Richards, A.B., M.D., S.D. 1935
Professor of Medicine, Harvard University; Director, Thorndike Memorial Laboratory, and Visiting Physician, Boston City Hospital, Boston, Mass.

Mitchell, Howard Hawks, Ph.D. 1925
Professor of Mathematics, University of Pennsylvania. 416 Sycamore Avenue, Merion, Pa.

Mitchell, Samuel Alfred, Ph.D., LL.D. 1923
Professor of Astronomy, Director, Leander McCormick Observatory, University of Virginia, University, Va.

† Deceased February 22, 1941.

Date of Election

Mitchell, Wesley Clair, A.B., Ph.D., LL.D., D.Litt. 1931
Professor of Economics, Columbia University; Director of Research, National Bureau of Economic Research. 2 Horatio Street, New York, N. Y.

Montgomery, James Alan, A.B., Ph.D., S.T.D., Litt.D. 1925
Philologist, Formerly Director and President, American Schools of Oriental Research; Professor Emeritus of Hebrew, Graduate School, University of Pennsylvania. 6806 Greene Street, Germantown, Philadelphia, Pa.

Moore, George Thomas, A.M., Ph.D. 1905
Botanist, Director, Missouri Botanical Garden, St. Louis, Mo.

Moore, J. Percy, Ph.D. 1918
Professor Emeritus of Zoology, University of Pennsylvania, Philadelphia, Pa.

Moore, John Bassett, LL.D. 1907
International Law, Diplomatist, Member, Permanent Court of Arbitration (1912–28); Judge, Permanent Court of International Justice (1921–28). 960 Park Avenue, New York, N. Y.

Morey, Charles Rufus, A.M., L.H.D. Litt.D. 1938
Marquand Professor of Art and Archaeology, Princeton University, Princeton, N. J.

Morgan, Marshall S., A.B. 1933
President, Fidelity-Philadelphia Trust Company. R.F.D. 2, Malvern, Pa.

Morgan, Thomas Hunt, B.S., Ph.D., D.Sc., LL.D. 1915
Zoologist, Director, Kerckhoff Laboratories of Biological Sciences, California Institute of Technology, Pasadena, Calif.

Morison, Samuel Eliot, Ph.D., M.A., Litt.D. 1937
Professor of History, Harvard University. Harvard College Library 417, Cambridge, Mass.

Morley, Sylvanus Griswold, Ph.D. 1940
In Charge, Carnegie Institution of Washington Archaeological Expeditions to Central America; Director, Chichen Itza Project. Apartado Postal 385, Merida, Yucatan, Mexico.

Date of Election

Morris, Harrison Smith 1899
Author, Formerly Managing Director, Pennsylvania Academy of the Fine Arts. Chelten Avenue and York Road, Philadelphia, Pa.

Morris, Lawrence J., A.B. 1936
Man of Affairs, Secretary, Pennsylvania Hospital. 240 South 4th Street, Philadelphia, Pa.

Morris, Roland S., A.B., LL.B., LL.D., D.C.L., L.H.D. 1922
Lawyer, Diplomatist, Professor of International Law, University of Pennsylvania; United States Ambassador to Japan (1917–21). 1617 Land Title Building, Philadelphia, Pa.

Morse, Marston, Ph.D., Sc.D. 1936
Professor of Mathematics, Institute for Advanced Study, Princeton, N. J.

Moulton, Forest Ray, A.B., Ph.D., Sc.D., LL.D. 1916
Mathematician, Astronomer, Permanent Secretary, American Association for the Advancement of Science, Smithsonian Institution Building, Washington, D. C.

Moulton, Harold Glenn, Ph.D., LL.D. 1938
Economist, President, The Brookings Institution, 722 Jackson Place, N. W., Washington, D. C.

Mulliken, Robert Sanderson, Ph.D., Sc.D. 1940
Professor of Physics, University of Chicago. 5712 Dorchester Avenue, Chicago, Ill.

Murlin, John Raymond, B.S., A.M., Ph.D., Sc.D. 1932
Professor of Physiology, Director, Department of Vital Economics, University of Rochester, 260 Crittenden Boulevard, Rochester, N. Y.

Nitze, William Albert, Ph.D., L.H.D. 1936
Professor of Romance Languages and Literatures, University of Chicago, Chicago, Ill.

Norris, George Washington 1937
Banker, Formerly Governor, Philadelphia Federal Reserve Bank. Land Title Building, Philadelphia, Pa.

Norris, George William, B.A., M.D. 1922
Physician, Author, Chief, Medical Service "A," Pennsylvania Hospital. Dimock, Susquehanna County, Pa.

	Date of Election
Northrop, John Howard, M.A., Ph.D., D.Sc., LL.D. Biochemist, Rockefeller Institute for Medical Research, Princeton, N. J.	1938
Novy, Frederick G., Sc.D., M.D., LL.D. Dean Emeritus, Medical School, Professor Emeritus of Bacteriology, University of Michigan, Ann Arbor, Mich.	1934
Noyes, William Albert, A.B., B.S., Ph.D., LL.D., Chem.D., D.Sc. Professor Emeritus of Chemistry, Noyes Laboratory of Chemistry, University of Illinois, Urbana, Ill.	1914
Ogburn, William Fielding, Ph.D., LL.D. Sewell L. Avery Distinguished Service Professor of Sociology, University of Chicago. 5525 Woodlawn Avenue, Chicago, Ill.	1940
Olivier, Charles P., M.A., Ph.D. Professor of Astronomy, Director, Flower Observatory, University of Pennsylvania, Upper Darby, Pa.	1932
O'Neill, Eugene Gladstone, Litt.D. Author, Playwright. Danville, Contra Costa County, Calif.	1935
Osgood, William Fogg, A.M., Ph.D., LL.D. Professor Emeritus of Mathematics, Harvard University. 10 Dorset Road, Belmont, Mass.	1915
Osterhout, Winthrop John Vanleuven, A.M., Ph.D., Sc.D. Physiologist, Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York, N. Y.	1917
Packard, Francis Randolph, M.D., LL.D. Physician, Author. 304 South 19th Street, Philadelphia, Pa.	1933
Painter, Theophilus Shickel, Ph.D., Sc.D. Professor of Zoology, University of Texas. 610 West 33rd Street, Austin, Texas.	1939
Parker, George Howard, Sc.D. Professor Emeritus of Zoology, Harvard University. 16 Berkeley Street, Cambridge, Mass.	1911
Paton, Stewart, M.A., M.D. Psychiatrist, Author. New York, N. Y.	1914

Date of Election

Patterson, Ernest Minor, A.B., A.M., Ph.D., LL.D. 1932
Professor of Economics, University of Pennsylvania.
404 South 47th Street, Philadelphia, Pa.

Patterson, Lamar Gray 1898
Chemist. Perdido Beach, Ala.

†Paul, J. Rodman, A.M. 1899
Lawyer. 1830 Land Title Building, Philadelphia, Pa.

Pauling, Linus Carl, Ph.D., Sc.D. 1936
Professor of Chemistry, Chairman, Division of Chemistry and Chemical Engineering, Director, Gates and Crellin Laboratories of Chemistry, California Institute of Technology, Pasadena, Calif.

Pender, Harold, A.B., Ph.D., Sc.D. 1917
Dean, Moore School of Electrical Engineering, University of Pennsylvania; Consulting Engineer, Philadelphia, Pa.

Penniman, Josiah Harmar, A.B., Ph.D., LL.D., Litt.D., L.H.D. 1901
Professor of English Literature, Provost Emeritus, University of Pennsylvania, Philadelphia, Pa.

Pepper, George Wharton, B.A., LL.B., LL.D., D.C.L. 1897
Lawyer, United States Senator (1922–27);
Formerly Professor of Law, University of Pennsylvania.
2231 Land Title Building, Philadelphia, Pa.

Pepper, William, A.B., M.D., Sc.D. 1937
Dean, School of Medicine, University of Pennsylvania.
Prospect Avenue, Melrose Park, Philadelphia, Pa.

Perry, Ralph Barton, Ph.D., Litt.D., L.H.D. 1939
Professor of Philosophy, Harvard University.
445 Widener Library, Cambridge, Mass.

Phelps, William Lyon, Ph.D., Litt.D., L.H.D., LL.D., D.D., D.S.T. 1927
Author, Professor Emeritus of English Literature, Yale University. 110 Whitney Avenue, New Haven, Conn.

Pound, Roscoe, Ph.D., LL.D., J.U.D., L.H.D. 1940
University Professor at Harvard.
304 School Street, Watertown, Mass.

† Deceased January 27, 1941.

Date of Election

Prince, John Dyneley, B.A., Ph.D. 1913
Orientalist and Comparative Philologist,
Professor Emeritus of East European Languages,
Philosophy Hall, Columbia University, New York, N. Y.

Putnam, Herbert, Litt.D., LL.D. 1937
Librarian of Congress Emeritus, Washington, D. C.

Quinn, Arthur Hobson, Ph.D., Litt.D. 1940
John Welch Centennial Professor of History and
English Literature, University of Pennsylvania.
401 Pembroke Road, Bala-Cynwyd, Pa.

Rand, Edward Kennard, A.B., A.M., Ph.D., Litt.D., LL.D. 1925
Pope Professor of Latin, Harvard University.
107 Lake View Avenue, Cambridge, Mass.

Ravenel, Mazÿck P., M.D. 1901
Physician, Editor-in-Chief, *American Journal of Public Health.* University of Missouri, Columbia, Mo.

Read, Conyers, A.B., Ph.D., B.Litt., Litt.D. 1934
Professor of English History, University of Pennsylvania.
226 South 16th Street, Philadelphia, Pa.

Reeves, Jesse S., Ph.D., L.H.D., LL.D. 1934
Professor of Political Science, University of Michigan.
1945 Cambridge Road, Ann Arbor, Mich.

Reid, Harry Fielding, C.E., A.B., Ph.D. 1910
Professor Emeritus of Dynamical Geology and
Geography, Johns Hopkins University, Baltimore, Md.

Reisner, George Andrew, Ph.D., D.Litt. 1940
Professor of Egyptology, Harvard University; Director,
Egyptian Expedition of Harvard University and Boston
Museum of Fine Arts; Curator, Egyptian Department,
Boston Museum of Fine Arts, Boston, Mass.

Repplier, Agnes, Litt.D. 1928
Author. 920 Clinton Street, Philadelphia, Pa.

Rhoads, Charles James, A.B. 1921
Banker (ret.), Trustee, Bryn Mawr College,
Haverford College. Bryn Mawr, Pa.

Richards, Alfred Newton, Ph.D., Sc.D., M.D., LL.D. 1935
Professor of Pharmacology, University of Pennsylvania.
6 Rugby Road, Bryn Mawr, Pa.

Date of Election

Richards, Horace Clark, A.B., Ph.D. 1907
Professor Emeritus of Mathematical Physics, University of Pennsylvania.
509 Woodland Terrace, Philadelphia, Pa.

Riddle, Oscar, A.B., Ph.D., LL.D. 1926
Physiologist, Carnegie Institution, Station for Experimental Evolution, Cold Spring Harbor, Long Island, N. Y.

Roberts, Owen J., A.B., LL.B., LL.D., D.C.L. 1934
Associate Justice, Supreme Court of the United States, Washington, D. C.

Robertson, Howard Percy, Ph.D. 1940
Professor of Mathematical Physics, Princeton University. 175 Prospect Avenue, Princeton, N. J.

Robinson, David Moore, Ph.D., LL.D., L.H.D., Litt.D. 1936
Professor of Archaeology and Epigraphy, Lecturer in Greek Literature, Johns Hopkins University, Baltimore, Md.

Rockefeller, John D., Jr., A.B., A.M., LL.D. 1931
Administrator, Trustee, Rockefeller Institute for Medical Research; Chairman of the Board, Rockefeller Foundation. 30 Rockefeller Plaza, New York, N. Y.

Rolfe, John Carew, Ph.D., Litt.D. 1907
Professor Emeritus of Latin, University of Pennsylvania.
The Fairfax, 43rd and Locust Streets, Philadelphia, Pa.

Rosenbach, A. S. W., B.S., Ph.D., D.F.A. 1928
Author, Bibliographer, President, Gratz College.
1320 Walnut Street, Philadelphia, Pa.

Rosengarten, Adolph G., B.S. 1940
President, Lankenau Hospital. St. Davids, Pa.

Rostovtzeff, Michael I., Ph.D., LL.D. 1929
Director of Archaeological Research, Yale University.
470 Whitney Avenue, New Haven, Conn.

Rous, Peyton, M.D., D.Sc. 1939
Member, Rockefeller Institute for Medical Research.
125 East 72nd Street, New York, N. Y.

	Date of Election
Rowe, Leo S., Ph.B., LL.B., Ph.D., LL.D. Director General, Pan-American Union, Washington, D. C.	1911
Russell, Henry Norris, A.M., Ph.D., D.Sc. Professor of Astronomy, Director, Princeton University Observatory. 79 Alexander Street, Princeton, N. J.	1913
Ruthven, Alexander G., B.S., Ph.D., LL.D., Sc.D. Zoologist, President, University of Michigan, Ann Arbor, Mich.	1931
Sanders, Henry A., A.B., A.M., Ph.D., L.H.D. Professor Emeritus of Latin, University of Michigan. 2037 Geddes Avenue, Ann Arbor, Mich.	1932
Sarton, George, D.Sc., L.H.D., LL.D. Historian of Science, Editor of *Isis*. Harvard Library 185, Cambridge, Mass.	1934
Scattergood, J. Henry, A.B. Man of Affairs, Treasurer, Haverford College, Bryn Mawr College. Villa Nova, Pa.	1931
Schaeffer, J. Parsons, A.M., M.D., Ph.D., Sc.D. Professor of General Anatomy, Director, Daniel Baugh Institute of Anatomy, Jefferson Medical College. 4634 Spruce Street, Philadelphia, Pa.	1927
Schelling, Felix E., Ph.D., Litt.D., LL.D. Professor Emeritus of English Literature, University of Pennsylvania. Lumberville, Pa.	1902
Schlesinger, Frank, B.S., M.A., Ph.D., Sc.D. Director, Yale University Observatory. Lyme, Conn.	1912
Schramm, Jacob Richard, A.B., Ph.D. Professor of Botany, Director, Department of Botany, Director, Morris Arboretum, University of Pennsylvania, Philadelphia, Pa.	1932
Schuchert, Charles, M.A., LL.D., Sc.D. Professor Emeritus of Paleontology, Peabody Museum, Yale University, New Haven, Conn.	1913
Schultz, Adolph H. Associate Professor of Physical Anthropology, School of Medicine, Johns Hopkins University, Baltimore, Md.	1936

Date of Election

Schurman, Jacob Gould, A.B., A.M., Sc.D., Ph.D., LL.D. 1908
Administrator, Diplomatist, President, Cornell University (1892–1920); United States Minister to China (1921–25); United States Ambassador to Germany (1925–30). 1 West 54th Street, New York, N. Y.

Scott, James Brown, A.B., A.M., J.U.D., LL.D. 1930
Secretary Emeritus, Carnegie Endowment for International Peace. Wardour, Annapolis, Md.

Scott, John Morin, A.B. 1926
Lawyer. 1903 Spruce Street, Philadelphia, Pa.

Scott, William Berryman, M.A., Ph.D., Sc.D., LL.D. 1886
Professor Emeritus of Geology and Paleontology, Princeton University. 7 Cleveland Lane, Princeton, N. J.

Seares, Frederick Hanley, B.S., LL.D. 1917
Astronomer, Assistant Director, Mount Wilson Observatory, Pasadena, Calif.

See, Thomas Jefferson Jackson, A.M., Lt.M., Sc.M., Ph.D., D.Sc. 1897
Physicist, Astronomer, Geometer, Professor of Mathematics, United States Navy (ret.).
614 Ohio Street, Vallejo, Calif.

Setchell, William Albert, A.M., Ph.D. 1919
Professor Emeritus of Botany, University of California, Berkeley, Calif.

Seymour, Charles, Ph.D., Litt.D., LL.D., L.H.D. 1939
President, Yale University.
43 Hillhouse Avenue, New Haven, Conn.

Shapley, Harlow, A.M., Ph.D., LL.D., Sc.D. 1922
Astronomer, Director, Harvard College Observatory, Cambridge, Mass.

Shear, Theodore Leslie, Ph.D., L.H.D. 1939
Professor of Classical Archaeology, Princeton University, Princeton, N. J.

Shotwell, James Thomson, Ph.D., LL.D. 1936
Professor of History, Columbia University; Trustee and Director, Division of Economics and History, Carnegie Endowment for International Peace.
405 West 117th Street, New York, N. Y.

Date of Election

Shull, George Harrison, B.S., Ph.D., Sc.D., LL.D. 1918
Professor of Botany and Genetics, Princeton University.
60 Jefferson Road, Princeton, N. J.

Simpson, George Gaylord, Ph.D. 1936
Associate Curator of Vertebrate Paleontology,
American Museum of Natural History, New York, N. Y.

Singer, Edgar Arthur, Jr., B.S., Ph.D. 1925
Professor of Philosophy, University of Pennsylvania.
4224 Chester Avenue, Philadelphia, Pa.

Sinnott, Edmund Ware, Ph.D. 1939
Sterling Professor of Botany, Yale University,
New Haven, Conn.

Sioussat, St. George Leakin, Ph.D. 1928
Chief, Division of Manuscripts, Incumbent, Chair of
American History, Library of Congress,
Washington, D. C.

Slater, John Clarke, Ph.D. 1940
Professor of Physics, Massachusetts Institute of
Technology, Cambridge, Mass.

Slipher, Vesto Melvin, A.M., Ph.D., LL.D., Sc.D. 1921
Astronomer, Director, Lowell Observatory,
Flagstaff, Ariz.

Smith, Preserved, A.M., Ph.D., Litt.D. 1937
Professor of History, Cornell University.
156 Cascadilla Park, Ithaca, N. Y.

Smyth, Charles Phelps, Ph.D. 1932
Professor of Chemistry, Princeton University.
22 Morven Street, Princeton, N. J.

Spoehr, Herman Augustus, Ph.D., Sc.D. 1931
Chairman, Division of Plant Biology, Carnegie Institution
of Washington, Stanford University, Calif.

Sprague, Oliver Mitchell Wentworth, A.M., Ph.D., Litt.D. 1938
Edmund Cogswell Converse Professor of Banking and
Finance, Harvard Graduate School of Business,
Soldier's Field, Boston, Mass.

Date of Election

Stakman, Elvin Charles, Ph.D., Dr.Nat.Science 1940
Professor and Chief, Division of Plant Pathology and Botany, University of Minnesota Experiment Station; Agent, United States Department of Agriculture. University Farm, St. Paul, Minn.

Stanley, Wendell Meredith, Ph.D., Sc.D. 1940
Biochemist, Member, Rockefeller Institute for Medical Research, Princeton, N. J.

Stebbins, Joel, Ph.D., Sc.D. 1925
Professor of Astronomy, Director, Washburn Observatory, University of Wisconsin, Madison, Wis.

Stefansson, Vilhjalmur, Ph.D., LL.D. 1923
Arctic Explorer, Geographer and Adviser on Northern Operations to Pan-American Airways. 67 Morton Street, New York, N. Y.

†Stillwell, Lewis Buckley, Sc.D. 1898
Electrical Engineer. Elm Road, Princeton, N. J.

Stone, Harlan Fiske, LL.B., LL.D. 1939
Associate Justice, Supreme Court of the United States. 2340 Wyoming Avenue, Washington, D. C.

Struve, Otto, Ph.D., Sc.D. 1937
Professor of Astrophysics, University of Chicago; Director, Yerkes Observatory, Williams Bay, Wis.

Sturtevant, Alfred Henry, Ph.D. 1936
Professor of Genetics, California Institute of Technology, Pasadena, Calif.

Sturtevant, Edgar Howard, Ph.D., L.H.D., LL.D. 1939
Professor of Linguistics, Yale University. 408 Whitney Avenue, New Haven, Conn.

Sumner, Francis Bertody, Ph.D. 1938
Professor of Biology, Scripps Institution of Oceanography, University of California, La Jolla, Calif.

Swann, William Francis Gray, M.A., D.Sc. 1926
Physicist, Director, Bartol Research Foundation, Whittier Place, Swarthmore, Pa.

† Deceased January 19, 1941.

	Date of Election
Tatlock, J. S. P., Ph.D., Litt.D., LL.D. Professor of English, University of California. 1994 San Antonio Street, Berkeley, Calif.	1937
Taylor, Deems, A.B., Mus.D., Litt.D. Musician, Composer, Writer. The Haviland Road, Stamford, Conn.	1934
Taylor, Henry Osborn, A.B., LL.B., D.Litt., L.H.D. Author, Historian. 135 East 66th Street, New York, N. Y.	1926
Taylor, Hugh Stott, D. Sc., LL.D. David B. Jones Professor of Chemistry, Chairman, Department of Chemistry, Princeton University. 115 Broadmead, Princeton, N. J.	1928
†Tennent, David Hilt, Ph.D. Research Professor of Biology, Bryn Mawr College. 818 Summit Grove Avenue, Bryn Mawr, Pa.	1938
Thorndike, Edward L., A.B., A.M., Ph.D., Sc.D., LL.D. Professor Emeritus of Educational Psychology, Teachers College, Columbia University, New York, N. Y.	1930
Thorndike, Lynn, Ph.D., L.H.D. Professor of History, Columbia University, New York, N. Y.	1939
Timoshenko, Stephen P., D.Sc. Professor of Theoretical and Applied Mechanics, Stanford University. 536 West Crescent Drive, Palo Alto, Calif.	1939
Tolman, Richard Chace, Ph.D. Professor of Physical Chemistry and Mathematical Physics, California Institute of Technology, Pasadena, Calif.	1932
Tozzer, Alfred Marston, A.B., A.M., Ph.D. Professor of Anthropology, Harvard University. 7 Bryant Street, Cambridge, Mass.	1937
Trelease, William, Sc.D., LL.D. Professor Emeritus of Botany, University of Illinois, Urbana, Ill.	1903

† Deceased January 14, 1941.

Date of Election

Tucker, Richard Hawley, C.E., Sc.D. 1908
Astronomer, Formerly of Lick Observatory.
1525 Waverly Street, Palo Alto, Calif.

Tyzzer, Ernest Edward, Ph.B., A.M., M.D., Sc.D. 1931
Professor of Comparative Pathology and Tropical Medicine, Harvard Medical School.
175 Water Street, Wakefield, Mass.

Urey, Harold Clayton, Ph.D., D.Sc., N.L. 1935
Professor of Chemistry, Executive Officer of the Department, Columbia University.
355 Highwood Avenue, Leonia, N. J.

Van Vleck, John Hasbrouck, Ph.D. 1939
Professor of Mathematical Physics, Harvard University, Cambridge, Mass.

Van Slyke, Donald Dexter, Ph.D., Sc.D., M.D. 1938
Biochemist, Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York, N. Y.

Vaughan, Thomas Wayland, B.Sci., A.M., Ph.D., LL.D. 1923
Director Emeritus, Scripps Institution of Oceanography; Principal Scientist (ret.), United States Geological Survey; Associate, United States National Museum.
3333 P Street, Washington, D. C.

Veblen, Oswald, A.B., Ph.D., D.Sc. 1912
Professor of Mathematics, Institute for Advanced Study.
58 Battle Road, Princeton, N. J.

von Neumann, John, Ph.D., C.E. 1938
Professor of Mathematics, Institute for Advanced Study.
26 Westcott Road, Princeton, N. J.

Warren, Charles, A.B., A.M., LL.D. 1939
Lawyer. 710 Mills Building, Washington, D. C.

Warren, Charles Hyde, Ph.B., Ph.D. 1928
Dean, Sheffield Scientific School, Professor of Geology, Yale University. 100 High Street, New Haven, Conn.

Webster, David Locke, A.B., Ph.D. 1922
Professor and Executive Head, Department of Physics, Stanford University, Calif.

Date of Election

Wetherill, Samuel Price, B.S., LL.D. 1933
Engineer. 1203 Morris Building, Philadelphia, Pa.

Wetmore, Alexander, A.B., M.S., Ph.D., D.Sc. 1930
Zoologist, Assistant Secretary, Smithsonian Institution; In Charge, United States National Museum, Washington, D. C.

Weyl, Hermann 1935
Professor of Mathematics, Institute for Advanced Study. Fine Hall, Princeton, N. J.

Whipple, George Hoyt, M.D., M.A., D.Sc., LL.D. 1938
Professor of Pathology, Dean, School of Medicine and Dentistry, University of Rochester. 320 Westminster Road, Rochester, N. Y.

Whitney, Willis R., S.B., Ph.D., Sc.D., Ch.D., LL.D. 1931
Chemist, Vice-president in Charge of Research, General Electric Company, Schenectady, N. Y.

Willis, Bailey, E.M., C.E., Ph.D. 1905
Professor Emeritus of Geology, Stanford University. Box 1365, Stanford University, Calif.

Willits, Joseph Henry, A.M., Ph.D., LL.D. 1938
Director for the Social Sciences, Rockefeller Foundation, 49 West 49th Street, New York, N. Y.

Wilson, Edwin Bidwell, A.B., Ph.D. 1917
Professor of Vital Statistics, Harvard School of Public Health. 55 Shattuck Street, Boston, Mass.

Wilson, George Grafton, Ph.D., LL.D. 1936
Professor Emeritus of International Law, Langdell Hall, Harvard University, Cambridge, Mass.

Wilson, Harold Albert, M.A., M.Sc., D.Sc. 1914
Professor of Physics, The Rice Institute, Houston, Texas

Winlock, Herbert Eustis, Art.D., Litt.D. 1939
Director Emeritus and Formerly Curator, Egyptian Department, Metropolitan Museum of Art, New York, N. Y.

Wissler, Clark, A.M., Ph.D., LL.D. 1924
Curator of Anthropology, American Museum of Natural History, New York, N. Y.

Date of Election

Witmer, Lightner, A.M., Ph.D. 1897
Professor Emeritus of Psychology, University of Pennsylvania. Box 186, Devon, Pa.

Woodworth, Robert Sessions, A.B., A.M., Ph.D., Sc.D., LL.D. 1936
Professor of Psychology, Columbia University, New York, N. Y.

Wright, Frederick E., Ph.D. 1914
Petrologist, Geophysical Laboratory, Carnegie Institution of Washington. 2134 Wyoming Avenue, Washington, D. C.

Wright, Sewall, B.S., M.S., Sc.D. 1932
Ernest D. Burton Distinguished Service Professor of Zoology, University of Chicago. 5762 Harper Avenue, Chicago, Ill.

Wright, William Hammond, D.Sc. 1935
Astronomer, Director, Lick Observatory, Mount Hamilton, Calif.

Yeatman, Pope, E.M., D.E. 1920
Mining Engineer. 165 Broadway, New York, N. Y.

Yerkes, Robert Mearns, Ph.D., D.Sc., LL.D. 1936
Director, Yale Laboratories of Primate Biology; Professor of Psychobiology, Yale University, 333 Cedar Street, New Haven, Conn.

Young, James Thomas, Ph.D. 1933
Political Scientist, Professor of Public Administration, University of Pennsylvania, Philadelphia, Pa.

Young, Owen D., A.B., D.H.L., LL.B., Litt.D., D.C.S. 1929
Lawyer, Honorary Chairman, General Electric Company. 570 Lexington Avenue, New York, N. Y.

Zeleny, John, M.A., Ph.D. 1915
Professor of Physics, Yale University. 44 Cold Spring Street, New Haven, Conn.

Total Resident Members—437

December 31, 1940.

FOREIGN MEMBERS

	Date of Election
Adams, Frank Dawson, Ph.D., D.Sc., LL.D., F.R.S. Geologist, Vice-principal Emeritus, McGill University, Montreal, Canada.	1916
Adrian, Edgar Douglas, M.A., M.D., Sc.D., LL.D., F.R.S. Professor of Physiology, Cambridge University. St. Chad's, Grange Road, Cambridge, England.	1938
Beneš, Eduard, Ph.D., LL.D. Formerly President, Czechoslovak Republic.	1939
Bohr, Niels Henrik David, Dr.phil. Professor of Theoretical Physics, University of Copenhagen; Director, Institute of Theoretical Physics. G. 1 Carlsberg, Copenhagen, Denmark.	1940
Bragg, Sir William Henry, D.Sc. Fullerian Professor of Chemistry, Royal Institution; Director, Davy-Faraday Research Laboratory. Royal Institution, Albemarle Street, W. 1, London, England.	1940
Cumont, Franz Valery Marie, D.Litt. Authority on Religions of the Roman Empire. 19 Corso d'Italia, Rome, Italy.	1940
Dale, Sir Henry Hallett, M.D., D.Sc., LL.D., F.R.S. Director, National Institute for Medical Research. Mt. Vernon House, Hampstead, London, N.W.3, England.	1939
de Broglie, Prince Louis Victor, D.Sc. Professor of Theoretical Physics, University of Paris. 94 Rue Perronet, Neuilly-sur-Seine, France.	1939
Debye, Peter Chairman of the Department of Chemistry and Professor of Chemistry, Cornell University, Ithaca, N. Y.	1936
Dirac, Paul Adrien Maurice, Ph.D., F.R.S. Lucasian Professor of Mathematics, Cambridge University. St. John's College, Cambridge, England.	1938

Date of Election

Eddington, Sir Arthur Stanley, M.A., B.Sc., D.Sc., LL.D., F.R.S. 1931
Astronomer, Director, The Observatory,
Cambridge, England.

Evans, Sir Arthur, Kt., M.A., D.Litt., LL.D., F.R.S., F.B.A. 1913
Extraordinary Professor of Prehistoric Archaeology,
Oxford University. Youlbury, Oxford, England.

Gooch, George Peabody, D.Litt. 1939
Honorary Fellow, Trinity College, Cambridge University.
76 Campden Hill Road, London, W.8, England.

Hardy, Godfrey Harold, D.Sc., LL.D., D.Phil. 1939
Sadleirian Professor of Pure Mathematics, University of
Cambridge; Fellow, Trinity College, Cambridge, England.

Heckscher, Eli Filip, Ph.D., D.Sc. 1940
Research Professor of Economic History, University of
Stockholm. Baldersgatan 10 a, Stockholm, Sweden.

Heisenberg, Werner, Ph.D. 1937
Professor of Theoretical Physics, University of Leipzig.
Bozenerweg 14, Leipzig, Germany.

Hilbert, David 1932
Professor of Mathematics, University of Göttingen.
Wilhelm-Weber-Strasse, Göttingen, Germany.

Hill, Archibald Vivian, Sc.D., LL.D., M.D. 1938
Physiologist, Foulerton Research Professor and Secretary
of the Royal Society. University of London, University
College, Gower Street, London, W.C.1, England.

Hjort, Johan, Ph.D., Sc.D. 1939
Professor of Marine Biology, Oslo University,
Oslo, Norway.

Hopkins, Sir Frederick Gowland, M.A., M.B., D.Sc., LL.D., D.C.L., F.R.S. 1937
Physiologist, Professor of Biochemistry, University of
Cambridge. Saxmeadham, Grange Road,
Cambridge, England.

Hu Shih, A.B., Ph.D., LL.D., Litt.D., L.H.D., D.C.L. 1936
Philosopher, Professor and Dean, College of
Letters, National University of Peking, Peiping;
Chinese Ambassador to United States.
Chinese Embassy, Washington, D. C.

Date of Election

Irvine, Sir James Colquhoun, C.B.E., Ph.D., Sc.D., LL.D., D.C.L., F.R.S. 1933
Chemist, Principal and Vice-chancellor, University of St. Andrews, Fifeshire, Scotland.

Janet, Pierre, Dr. ès lettres, Dr. en médicine, Sc.D. 1940
Professor of Psychology, Collège de France; Director, Laboratoire de Psychologie pathologique, Clinique de la Salpêtrière. Rue de Varenne 54, Paris VII, France.

Keith, Sir Arthur, Kt., F.R.S., M.D., D.Sc., F.R.C.S., LL.D. 1931
Anthropologist, Master, Buckston Browne Research Farm, Downe, Farnborough, Kent, England.

Keith, Arthur Berriedale, D.C.L., D.Litt., LL.D. 1935
Barrister at Law, Advocate and Orientalist, Regius Professor of Sanskrit and Comparative Philology, Lecturer on the Constitution of the British Empire, University of Edinburgh, Edinburgh, Scotland.

Kenyon, Sir Frederic George, M.A., D.Litt., LL.D., L.H.D., Ph.D. 1937
Archaeologist and Philologist, Secretary, British Academy; Formerly President, London Society of Antiquaries; Formerly Director, British Museum. Kirkstead, Godstone, Surrey, England.

Larmor, Sir Joseph, Kt., M.A., Sc.D., LL.D., D.C.L., F.R.S. 1913
Physicist, Professor Emeritus of Mathematics, Cambridge University; Fellow, St. John's College. Holywood, Northern Ireland.

Levi-Civita, Tullio, Dr.Math., Dr. honoris causa 1940
Professor of Mechanics, University of Rome. Via Sardegna 50, Rome, Italy.

de Margerie, Emmanuel 1932
Geologist, Formerly President, Geological Society of France. 110 Rue du Bac, Paris VII, France.

Nilsson, Martin P., Ph.D. 1939
Professor of Classical Archaeology and Ancient History, University of Lund. Bredgatan 25, Lund, Sweden.

Penck, Albrecht F. K., Ph.D., Sc.D. 1908
Professor Emeritus of Geography, University of Berlin. Meierottostrasse 511, Berlin W15, Germany.

Date of Election

Petrie (William Matthew), Sir Flinders, Kt., D.C.L., Litt.D., LL.D., Ph.D., F.R.S., F.S.A. 1905
Professor Emeritus of Egyptology, University College, London; Founder, British School of Egyptian Archaeology. Care American Schools of Oriental Research, Jerusalem, Palestine.

Picard, Emile, Sc.D. 1910
Mathematician, Permanent Secretary, Academy of Sciences; Professor, Paris University. 25 Quai Conti, Paris (vi), France.

Pidal, Ramón Menéndez, Dr. honoris causa 1940
Professor of Romance Philology, University of Madrid, Madrid, Spain.

Planck, Max, Ph.D., M.D., D.Sc. 1933
Professor of Physics, University of Berlin, Berlin, Germany.

Plaskett, John Stanley, C.B.E., B.A., D.Sc., LL.D., F.R.S. 1930
Director (ret.), Dominion Astrophysical Observatory. 318 Armit Street, Esquimalt, Victoria, B. C., Canada.

Prain, Sir David, Kt., M.A., M.B., LL.D., F.R.S. 1917
Botanist, Formerly Trustee, British Museum and Director, Royal Botanic Gardens, Kew. The Well Farm, Whyteleafe, Surrey, England.

Richardson, Sir Owen Willans, Kt., M.A., D.Sc., LL.D., F.R.S. 1910
Physicist, Yarrow Research Professor of the Royal Society; Director of Research in Physics, Kings College, London. Chandos Lodge, Alton, Hants, England.

Rist, Charles, LL.D. 1938
Professor of Political Economy, University of Paris. 18 bis, Rue du Parc de Clagny, Versailles, France.

Spemann, Hans, Ph.D., Sc.D. 1937
Professor of Zoology, Freiburg University. Freiburg, I.B., Mercystrasse 35, Germany.

Stamp, Josiah Charles (1st Baron of Shortlands), D.Sc., LL.D. 1940
Economist, Chairman, London, Midland and Scottish Railway; Director, Bank of England. Tantallon, Park Hill Road, Shortlands, Kent, England.

	Date of Election
Stein, Sir Aurel, Ph.D., D.Litt., D.Sc., D.O.L. Archaeologist and Geographer. Srinagar, Kashmir.	1939
Szombathy, Josef Hofrat Anthropologist. Vienna XIX, Obkirchergasse 15, Germany.	1886
Temperley, Harold William Vazeille, M.A., Litt.D. Professor of Modern History, Cambridge University; Master of Peterhouse, Cambridge, England.	1938
Wilkins, Sir Hubert, Kt., M.C., F.R.G.S., M.B.O.U. Geographer. Royal Society's Club, St. James, London, England.	1930

Total Foreign Members—45

December 31, 1940.

CLASSIFIED LIST OF MEMBERS

CLASS I. MATHEMATICAL AND PHYSICAL SCIENCES

Mathematics

Alexander, James W.............................Princeton, N. J.
Bateman, Harry.............................Pasadena, Calif.
Bell, Eric Temple.............................Pasadena, Calif.
Birkhoff, George David.........................Cambridge, Mass.
Bliss, Gilbert Ames.............................Chicago, Ill.
Coble, Arthur Byron.............................Urbana, Ill.
Dirac, Paul Adrien Maurice.................Cambridge, England
Dresden, Arnold.............................Swarthmore, Pa.
Eisenhart, Luther Pfahler.......................Princeton, N. J.
Hardy, Godfrey Harold.....................Cambridge, England
Henderson, Robert.........................Crown Point, N. Y.
Hilbert, David.............................Göttingen, Germany
Huntington, Edward Vermilye.................Cambridge, Mass.
Lefschetz, Solomon.............................Princeton, N. J.
Lovett, Edgar Odell.............................Houston, Texas
Mitchell, Howard Hawks.............................Merion, Pa.
Morse, Marston.............................Princeton, N. J.
Osgood, William Fogg.............................Belmont, Mass.
Picard, Emile.............................Paris, France
Veblen, Oswald.............................Princeton, N. J.
von Neumann, John.............................Princeton, N. J.
Weyl, Hermann.............................Princeton, N. J.

Astronomy

Abbot, Charles Greeley.......................Washington, D. C.
Adams, Walter Sydney.........................Pasadena, Calif.
Aitken, Robert Grant.............................Berkeley, Calif.
Cannon, Annie J.............................Cambridge, Mass.
Curtis, Heber Doust.............................Ann Arbor, Mich.
Eddington, Arthur Stanley.................Cambridge, England
Gaposchkin, Cecilia Payne.....................Cambridge, Mass.
Hubble, Edwin P.............................Pasadena, Calif.

Lampland, Carl O. .... Flagstaff, Ariz.
Leuschner, Armin Otto .... Berkeley, Calif.
Merrill, Paul Willard .... Pasadena, Calif.
Miller, John Anthony .... Wallingford, Pa.
Mitchell, Samuel Alfred .... University, Va.
Moulton, Forest Ray .... Washington, D. C.
Olivier, Charles P. .... Upper Darby, Pa.
Plaskett, John Stanley .... Victoria, B. C., Canada
Russell, Henry Norris .... Princeton, N. J.
Schlesinger, Frank .... Lyme, Conn.
Seares, Frederick Hanley .... Pasadena, Calif.
Shapley, Harlow .... Cambridge, Mass.
Slipher, Vesto Melvin .... Flagstaff, Ariz.
Stebbins, Joel .... Madison, Wis.
Struve, Otto .... Williams Bay, Wis.
Tucker, Richard Hawley .... Palo Alto, Calif.
Wright, William Hammond .... Mt. Hamilton, Calif.

Physics

Adams, Edwin Plimpton .... Princeton, N. J.
Anderson, Carl David .... Pasadena, Calif.
Beams, Jesse Wakefield .... University, Va.
Bohr, Niels Henrik David .... Copenhagen, Denmark
Bowen, Ira Sprague .... Pasadena, Calif.
Bridgman, Percy Williams .... Cambridge, Mass.
Briggs, Lyman J. .... Washington, D. C.
Compton, Arthur Holly .... Chicago, Ill.
Compton, Karl Taylor .... Cambridge, Mass.
Coolidge, William David .... Schenectady, N. Y.
Crew, Henry .... Evanston, Ill.
Darrow, Karl Kelchner .... New York, N. Y.
Davisson, Clinton J. .... New York, N. Y.
de Broglie, Louis Victor .... Neuilly-sur-Seine, France
Debye, Peter .... Ithaca, N. Y.
Dempster, Arthur Jeffrey .... Chicago, Ill.
Einstein, Albert .... Princeton, N. J.
Fermi, Enrico .... New York, N. Y.
Foote, Paul Darwin .... Pittsburgh, Pa.
Franck, James .... Chicago, Ill.
Goodspeed, Arthur Willis .... Philadelphia, Pa.
Heisenberg, Werner .... Leipzig, Germany
Humphreys, William Jackson .... Washington, D. C.
Ives, Herbert E. .... Montclair, N. J.
Larmor, Joseph .... Holywood, Northern Ireland

Lawrence, Ernest Orlando........................Berkeley, Calif.
Levi-Civita, Tullio..................................Rome, Italy
Loomis, Alfred Lee........................Tuxedo Park, N. Y.
Lyman, Theodore..............................Cambridge, Mass.
Magie, William Francis.........................Princeton, N. J.
†Miller, Dayton Clarence.........................Cleveland, Ohio
Millikan, Robert Andrews.......................Pasadena, Calif.
Mulliken, Robert Sanderson..........................Chicago, Ill.
Planck, Max......................................Berlin, Germany
Richards, Horace Clark.........................Philadelphia, Pa.
Richardson, Owen Willans...................Alton, Hants, England
Robertson, Howard Percy.........................Princeton, N. J.
See, Thomas Jefferson Jackson.......................Vallejo, Calif.
Slater, John Clarke..............................Cambridge, Mass.
Swann, William Francis Gray....................Swarthmore, Pa.
Tolman, Richard Chace.........................Pasadena, Calif.
Van Vleck, John Hasbrouck......................Cambridge, Mass.
Webster, David Locke..................Stanford University, Calif.
Wilson, Harold Albert...........................Houston, Texas
Zeleny, John....................................New Haven, Conn.

Chemistry

Adams, Roger.......................................Urbana, Ill.
Andrews, Donald Hatch...........................Baltimore, Md.
Baekeland, Leo H...............................New York, N. Y.
Bancroft, Wilder Dwight............................Ithaca, N. Y.
deBenneville, James S.........................Philadelphia, Pa.
Bogert, Marston Taylor.........................New York, N. Y.
Bragg, William Henry...........................London, England
Clark, William Mansfield.........................Baltimore, Md.
Conant, James Bryant..........................Cambridge, Mass.
Cottrell, Frederick Gardner....................Washington, D. C.
Du Pont, Francis I...............................Wilmington, Del.
Du Pont, Pierre Samuel.........................Wilmington, Del.
Giauque, William Francis.........................Berkeley, Calif.
Gomberg, Moses..................................Ann Arbor, Mich.
Harkins, William Draper...........................Chicago, Ill.
Hawk, Philip Bovier.....................Long Island City, N. Y.
Hopkins, B Smith...................................Urbana, Ill.
Hulett, George A..................................Princeton, N. J.
Irvine, James Colquhoun.......................Fifeshire, Scotland
Keyes, Frederick George........................Cambridge, Mass.
Kistiakowsky, George Bogdan...................Cambridge, Mass.

† Deceased.

Kraus, Charles August........................Providence, R. I.
Lamb, Arthur Becket........................Cambridge, Mass.
Langmuir, Irving........................Schenectady, N. Y.
Lewis, Gilbert Newton........................Berkeley, Calif.
Mees, Charles Edward Kenneth................Rochester, N. Y.
Northrop, John Howard........................Princeton, N. J.
Noyes, William Albert........................Urbana, Ill.
Patterson, Lamar Gray........................Perdido Beach, Ala.
Pauling, Linus Carl........................Pasadena, Calif.
Smyth, Charles Phelps........................Princeton, N. J.
Stanley, Wendell Meredith........................Princeton, N. J.
Taylor, Hugh Stott........................Princeton, N. J.
Urey, Harold Clayton........................Leonia, N. J.
Van Slyke, Donald Dexter........................New York, N. Y.
Whitney, Willis R........................Schenectady, N. Y.

Engineering

Bush, Vannevar........................Washington, D. C.
Davis, Harvey N........................Hoboken, N. J.
Derleth, Charles, Jr........................Berkeley, Calif.
Dunn, Gano........................New York, N. Y.
Durand, William Frederick............Stanford University, Calif.
Emmet, William LeRoy........................Schenectady, N. Y.
Hoover, Herbert........................Stanford University, Calif.
Hunsaker, Jerome Clarke........................Boston, Mass.
Jackson, Dugald Caleb........................Cambridge, Mass.
Jewett, Frank Baldwin........................New York, N. Y.
Kettering, Charles Franklin........................Dayton, Ohio
Pender, Harold........................Philadelphia, Pa.
†Stillwell, Lewis Buckley........................Princeton, N. J.
Timoshenko, Stephen P........................Palo Alto, Calif.
Wetherill, Samuel Price........................Philadelphia, Pa.
Yeatman, Pope........................New York, N. Y.

CLASS II. GEOLOGICAL AND BIOLOGICAL SCIENCES

Geology, Paleontology, Geography

Adams, Frank Dawson........................Montreal, Canada
Berkey, Charles Peter........................New York, N. Y.
Berry, Edward Wilber........................Baltimore, Md.
Blackwelder, Eliot....................Stanford University, Calif.

† Deceased.

Bowen, Norman L. .... Chicago, Ill.
Bowman, Isaiah .... Baltimore, Md.
Bryant, William L. .... Providence, R. I.
Buddington, Arthur F. .... Princeton, N. J.
Byrd, Richard Evelyn .... Boston, Mass.
Case, Ermine Cowles .... Ann Arbor, Mich.
Cross, Whitman .... Chevy Chase, Md.
Daly, Reginald Aldworth .... Cambridge, Mass.
Day, Arthur L. .... Bethesda, Md.
Gregory, Herbert Ernest .... Honolulu, Hawaii
Gregory, William King .... New York, N. Y.
Hobbs, William Herbert .... Ann Arbor, Mich.
Johnson, Douglas .... New York, N. Y.
Lawson, Andrew Cowper .... Berkeley, Calif.
Leith, Charles Kenneth .... Madison, Wis.
Leverett, Frank .... Ann Arbor, Mich.
de Margerie, Emmanuel .... Paris, France
Merriam, John C. .... Washington, D. C.
Penck, Albrecht F. K. .... Berlin, Germany
Reid, Harry Fielding .... Baltimore, Md.
Schuchert, Charles .... New Haven, Conn.
Scott, William Berryman .... Princeton, N. J.
Simpson, George Gaylord .... New York, N. Y.
Stefansson, Vilhjalmur .... New York, N. Y.
Vaughan, Thomas Wayland .... Washington, D. C.
Warren, Charles Hyde .... New Haven, Conn.
Wilkins, Hubert .... London, England
Willis, Bailey .... Stanford University, Calif.
Wright, Frederick E. .... Washington, D. C.

Zoology, Anatomy

Andrews, Roy Chapman .... New York, N. Y.
Barbour, Thomas .... Boston, Mass.
Bigelow, Henry Bryant .... Cambridge, Mass.
Birge, Edward Asahel .... Madison, Wis.
Bumpus, Hermon Carey .... Duxbury, Mass.
Calvert, Philip Powell .... Cheyney, Pa.
Castle, William Ernest .... Berkeley, Calif.
Chapman, Frank Michler .... New York, N. Y.
Cockerell, Theodore D. A. .... Boulder, Colo.
Coghill, George Ellett .... Gainesville, Fla.
Conklin, Edwin Grant .... Princeton, N. J.
Corner, George Washington .... Baltimore, Md.

Dahlgren, Ulric................................Princeton, N. J.
Davenport, Charles Benedict.....Cold Spring Harbor, L. I., N. Y.
Detwiler, Samuel Randall........................New York, N. Y.
Harrison, Ross G............................New Haven, Conn.
Hisaw, Frederick............................Cambridge, Mass.
Hjort, Johan....................................Oslo, Norway
Howard, Leland Ossian.......................Washington, D. C.
Jennings, Herbert S........................Los Angeles, Calif.
Kofoid, Charles A..............................Berkeley, Calif.
Lillie, Frank Rattray............................Chicago, Ill.
McClung, Clarence E.............................Urbana, Ill.
McClure, Charles F. W.........................Princeton, N. J.
McGregor, James Howard.......................New York, N. Y.
Mark, Edward Laurens........................Cambridge, Mass.
Miller, Gerrit Smith, Jr......................Washington, D. C.
Moore, J. Percy.............................Philadelphia, Pa.
Morgan, Thomas Hunt...........................Pasadena, Calif.
Painter, Theophilus Shickel......................Austin, Texas
Parker, George Howard.......................Cambridge, Mass.
Ruthven, Alexander G........................Ann Arbor, Mich.
Schaeffer, J. Parsons.........................Philadelphia, Pa.
Schultz, Adolph H.............................Baltimore, Md.
Spemann, Hans...............................Freiburg, Germany
Sturtevant, Alfred Henry......................Pasadena, Calif.
Sumner, Francis Bertody.......................La Jolla, Calif.
†Tennent, David Hilt..........................Bryn Mawr, Pa.
Wetmore, Alexander..........................Washington, D. C.
Wright, Sewall.....................................Chicago, Ill.

Botany, Bacteriology

Allen, Charles Elmer...........................Madison, Wis.
Arthur, Joseph Charles..........................Lafayette, Ind.
Bailey, Irving Widmer........................Cambridge, Mass.
Bailey, Liberty Hyde............................Ithaca, N. Y.
Bartlett, Harley Harris........................Ann Arbor, Mich.
Blakeslee, Albert Francis........Cold Spring Harbor, L. I., N. Y.
Campbell, Douglas Houghton...........Stanford University, Calif.
Cleland, Ralph Erskine.......................Bloomington, Ind.
Crocker, William................................Yonkers, N. Y.
Davis, Bradley Moore.........................Ann Arbor, Mich.
Duggar, Benjamin Minge..........................Madison, Wis.
Fernald, Merritt Lyndon......................Cambridge, Mass.

† Deceased.

Harper, Robert A. .... New York, N. Y.
Jones, Lewis Ralph .... Madison, Wis.
Livingston, Burton E. .... Riderwood, Md.
MacDougal, Daniel Trembly .... Carmel, Calif.
Macfarlane, John Muirhead .... Philadelphia, Pa.
Merrill, Elmer Drew .... Jamaica Plain, Mass.
Moore, George Thomas .... St. Louis, Mo.
Novy, Frederick G. .... Ann Arbor, Mich.
Prain, David .... Whyteleafe, Surrey, England
Schramm, Jacob Richard .... Philadelphia, Pa.
Setchell, William Albert .... Berkeley, Calif.
Shull, George Harrison .... Princeton, N. J.
Sinnott, Edmund Ware .... New Haven, Conn.
Spoehr, Herman Augustus .... Stanford University, Calif.
Stakman, Elvin Charles .... St. Paul, Minn.
Trelease, William .... Urbana, Ill.

Anthropology, Psychology

Angell, James Rowland .... New Haven, Conn.
Boas, Franz .... Grantwood, N. J.
Cattell, James McKeen .... Garrison, N. Y.
Hooton, Earnest A. .... Cambridge, Mass.
Hrdlička, Aleš .... Washington, D. C.
Janet, Pierre .... Paris, France
Keith, Arthur .... Farnborough, Kent, England
Köhler, Wolfgang .... Swarthmore, Pa.
Lashley, Karl Spencer .... Cambridge, Mass.
MacCurdy, George Grant .... Old Lyme, Conn.
Paton, Stewart .... New York, N. Y.
Szombathy, Josef Hofrat .... Vienna, Germany
Thorndike, Edward L. .... New York, N. Y.
Tozzer, Alfred Marston .... Cambridge, Mass.
Wissler, Clark .... New York, N. Y.
Witmer, Lightner .... Devon, Pa.
Woodworth, Robert Sessions .... New York, N. Y.
Yerkes, Robert Mearns .... New Haven, Conn.

Physiology, Pathology

Adrian, Edgar Douglas .... Cambridge, England
Benedict, Francis Gano .... Machiasport, Maine
Bronk, Detlev W. .... New York, N. Y.
Brubaker, Albert P. .... Philadelphia, Pa.
Cannon, Walter Bradford .... Boston, Mass.

Carlson, Anton Julius....................................Chicago, Ill.
Chittenden, Russell H..........................New Haven, Conn.
Dale, Henry Hallett..............................London, England
Erlanger, Joseph...................................St. Louis, Mo.
Flexner, Simon.....................................New York, N. Y.
Forbes, Alexander.................................Boston, Mass.
Fox, Herbert..Philadelphia, Pa.
Gasser, Herbert Spencer..........................New York, N. Y.
Gies, William J.....................................New York, N. Y.
Harvey, E. Newton.................................Princeton, N. J.
Henderson, Lawrence J..........................Cambridge, Mass.
Henderson, Yandell...............................New Haven, Conn.
Hill, Archibald Vivian............................London, England
Hopkins, Frederick Gowland..................Cambridge, England
Howell, William Henry...........................Baltimore, Md.
Jacobs, Merkel Henry............................Philadelphia, Pa.
Landsteiner, Karl..................................New York, N. Y.
Lillie, Ralph Stayner.................................Chicago, Ill.
Loeb, Leo...St. Louis, Mo.
Long, Esmond Ray................................Philadelphia, Pa.
Murlin, John Raymond...........................Rochester, N. Y.
Osterhout, Winthrop J. V.......................New York, N. Y.
Richards, Alfred Newton........................Bryn Mawr, Pa.
Riddle, Oscar....................Cold Spring Harbor, L. I., N. Y.
Tyzzer, Ernest Edward..........................Wakefield, Mass.
Whipple, George Hoyt...........................Rochester, N. Y.

Medicine, Pharmacology, Surgery

Carrel, Alexis......................................New York, N. Y.
Castle, William Bosworth.........................Boston, Mass.
Crile, George......................................Cleveland, Ohio
Darrach, William..................................New York, N. Y.
DuBois, Eugene Floyd............................New York, N. Y.
Griffith, J. P. Crozer............................Philadelphia, Pa.
Heiser, Victor George...............................Bantam, Conn.
Joslin, Elliott Proctor................................Boston, Mass.
MacNider, William de Berniere.................Chapel Hill, N. C.
Minot, George Richards...........................Boston, Mass.
Norris, George William.............................Dimock, Pa.
Packard, Francis Randolph.....................Philadelphia, Pa.
Pepper, William.............................. Philadelphia, Pa.
Ravenel, Mazÿck P...............................Columbia, Mo.
Rous, Peyton......................................New York, N. Y.

CLASS III. SOCIAL SCIENCES

Economics, Statistics, Sociology

Commons, John Rogers........................Ft. Lauderdale, Fla.
Day, Edmund Ezra..............................Ithaca, N. Y.
Dodds, Harold Willis..........................Princeton, N. J.
Fetter, Frank Albert..........................Princeton, N. J.
Fisher, Irving................................New Haven, Conn.
Gay, Edwin Francis............................Pasadena, Calif.
Heckscher, Eli Filip..........................Stockholm, Sweden
Huebner, Solomon Stephen......................Merion, Pa.
Johnson, Emory R..............................Philadelphia, Pa.
Kemmerer, Edwin Walter........................Princeton, N. J.
Mitchell, Wesley Clair........................New York, N. Y.
Moulton, Harold Glenn.........................Washington, D. C.
Ogburn, William Fielding......................Chicago, Ill.
Patterson, Ernest Minor.......................Philadelphia, Pa.
Rist, Charles ....Versailles, France
Sprague, Oliver M. W..........................Boston, Mass.
Stamp, Josiah Charles.................Shortlands, Kent, England
Willits, Joseph Henry.........................New York, N. Y.
Wilson, Edwin Bidwell.........................Boston, Mass.
Young, James Thomas ....Philadelphia, Pa.

Modern History

Adams, James Truslow..........................Southport, Conn.
Andrews, Charles McLean.......................New Haven, Conn.
Armstrong, Hamilton Fish......................New York, N. Y.
Beard, Charles Austin.........................New Milford, Conn.
Becker, Carl L................................Ithaca, N. Y.
Bolton, Herbert Eugene........................Berkeley, Calif.
Cheyney, Edward Potts.........................Media, Pa.
Farrand, Max..................................San Marino, Calif.
Ford, Guy Stanton.............................Minneapolis, Minn.
†Ford, Worthington Chauncey...................Le Cannet, France
Fox, Dixon Ryan...............................Schenectady, N. Y.
Gooch, George Peabody.........................London, England
Greene, Evarts B......................Croton-on-Hudson, N. Y.
Hayes, Carlton Joseph Huntley.................New York, N. Y.
Hazen, Charles D..............................New York, N. Y.
Lingelbach, William E.........................Philadelphia, Pa.
McIlwain, Charles Howard ....Belmont, Mass.

† Deceased.

Morison, Samuel Eliot..........................Cambridge, Mass.
Read, Conyers..........................Philadelphia, Pa.
Seymour, Charles..........................New Haven, Conn.
Shotwell, James Thomson..........................New York, N. Y.
Sioussat, St. George Leakin..........................Washington, D. C.
Temperley, Harold William Vazeille..........Cambridge, England

Jurisprudence

Chamberlain, Joseph Perkins..........................New York, N. Y.
Corwin, Edward Samuel..........................Princeton, N. J.
Davis, John William..........................New York, N. Y.
Dickinson, John..........................Philadelphia, Pa.
Duane, Morris..........................Rosemont, Pa.
Frankfurter, Felix..........................Washington, D. C.
Goodrich, Herbert Funk..........................Philadelphia, Pa.
Hughes, Charles Evans..........................Washington, D. C.
Jessup, Philip C..........................New York, N. Y.
Miller, Hunter..........................Victoria, B. C., Canada
Moore, John Bassett..........................New York, N. Y.
Morris, Roland S..........................Philadelphia, Pa.
†Paul, J. Rodman..........................Philadelphia, Pa.
Pepper, George Wharton..........................Philadelphia, Pa.
Pound, Roscoe..........................Watertown, Mass.
Reeves, Jesse S..........................Ann Arbor, Mich.
Roberts, Owen J..........................Washington, D. C.
Scott, James Brown..........................Annapolis, Md.
Scott, John Morin..........................Philadelphia, Pa.
Stone, Harlan Fiske..........................Washington, D. C.
Warren, Charles..........................Washington, D. C.
Wilson, George Grafton..........................Cambridge, Mass.

Administration, Government

Beneš, Eduard..........................London, England
Butler, Nicholas Murray..........................New York, N. Y.
Delano, Frederic Adrian..........................Washington, D. C.
Fosdick, Raymond Blaine..........................New York, N. Y.
Gates, Thomas Sovereign..........................Philadelphia, Pa.
Gifford, Walter Sherman..........................New York, N. Y.
Guggenheim, William..........................New York, N. Y.
Keith, Arthur Berriedale..........................Edinburgh, Scotland
Lowell, Abbott Lawrence..........................Boston, Mass.

† Deceased.

Merriam, Charles Edward........................Chicago, Ill.
Putnam, Herbert........................Washington, D. C.
Rockefeller, John D., Jr........................New York, N. Y.
Rowe, Leo S........................Washington, D. C.
Schurman, Jacob Gould........................New York, N. Y.
Young, Owen D........................New York, N. Y.

Affairs

Fels, Samuel S........................Philadelphia, Pa.
Hayward, Nathan........................Philadelphia, Pa.
Hopkinson, Edward, Jr........................Philadelphia, Pa.
Jenks, John Story........................Philadelphia, Pa.
Johnson, Eldridge Reeves........................Camden, N. J.
Lamont, Thomas William........................New York, N. Y.
Leeds, Morris Evans........................Philadelphia, Pa.
Mason, William Smith........................Evanston, Ill.
Morgan, Marshall S........................Malvern, Pa.
Morris, Lawrence J........................Philadelphia, Pa.
Norris, George Washington........................Philadelphia, Pa.
Rhoads, Charles James........................Bryn Mawr, Pa.
Rosengarten, Adolph G........................St. Davids, Pa.
Scattergood, J. Henry........................Villa Nova, Pa.

CLASS IV. HUMANITIES

Philosophy, Education

Dewey, John........................New York, N. Y.
Graves, Frank Pierrepont........................Albany, N. Y.
Haney, John Louis........................Philadelphia, Pa.
Hu Shih........................Washington, D. C.
Keppel, Frederick Paul........................New York, N. Y.
Lovejoy, Arthur Oncken........................Baltimore, Md.
Penniman, Josiah Harmar........................Philadelphia, Pa.
Perry, Ralph Barton........................Cambridge, Mass.
Singer, Edgar Arthur, Jr........................Philadelphia, Pa.

Ancient, Medieval and Cultural History

Chinard, Gilbert........................Princeton, N. J.
Cumont, Franz Valery Marie........................Rome, Italy
Ferguson, William Scott........................Cambridge, Mass.
Leland, Waldo G........................Washington, D. C.
Rostovtzeff, Michael I........................New Haven, Conn.
Sarton, George........................Cambridge, Mass.

Smith, Preserved....................................Ithaca, N. Y.
Taylor, Henry Osborn..........................New York, N. Y.
Thorndike, Lynn................................New York, N. Y.

Archaeology

Albright, William F...............................Baltimore, Md.
Barton, George Aaron.......................Coconut Grove, Fla.
Carpenter, Rhys..............................Downingtown, Pa.
Chase, George Henry...........................Cambridge, Mass.
Dinsmoor, William Bell........................New York, N. Y.
Evans, Arthur..................................Oxford, England
Holland, Leicester Bodine.....................Philadelphia, Pa.
Jayne, Horace Howard Furness..................New York, N. Y.
Kenyon, Frederic George..............Godstone, Surrey, England
Kidder, Alfred Vincent........................Cambridge, Mass.
Meritt, Benjamin Dean...........................Princeton, N. J.
Morley, Sylvanus Griswold...............Merida, Yucatan, Mexico
Nilsson, Martin P...................................Lund, Sweden
Petrie, Flinders...........................Jerusalem, Palestine
Reisner, George Andrew...........................Boston, Mass.
Robinson, David Moore..........................Baltimore, Md.
Shear, Theodore Leslie..........................Princeton, N. J.
Stein, Aurel....................................Srinagar, Kashmir
Winlock, Herbert Eustis........................New York, N. Y.

Philology and Languages

Armstrong, Edward Cooke.......................Princeton, N. J.
Beeson, Charles Henry.............................Chicago, Ill.
Bonner, Campbell.............................Ann Arbor, Mich.
Buck, Carl Darling.................................Chicago, Ill.
Capps, Edward....................................Princeton, N. J.
Edgerton, Franklin............................New Haven, Conn.
Gulick, Charles Burton.........................Cambridge, Mass.
Hendrickson, George Lincoln..................New Haven, Conn.
Lancaster, Henry Carrington....................Baltimore, Md.
†Lanman, Charles R.............................Cambridge, Mass.
McDaniel, Walton Brooks...................Coconut Grove, Fla.
Matthews, Albert...................................Boston, Mass.
Montgomery, James Alan.......................Philadelphia, Pa.
Nitze, William Albert..............................Chicago, Ill.
Pidal, Ramón Menéndez...........................Madrid, Spain

† Deceased.

Prince, John Dyneley........................New York, N. Y.
Rand, Edward Kennard........................Cambridge, Mass.
Rolfe, John Carew........................Philadelphia, Pa.
Sanders, Henry A........................Ann Arbor, Mich.
Sturtevant, Edgar Howard........................New Haven, Conn.
Tatlock, John S. P........................Berkeley, Calif.

Literature, Fine Arts

Adams, Joseph Quincy........................Washington, D. C.
Aydelotte, Frank........................Princeton, N. J.
Brooke, C. F. Tucker........................New Haven, Conn.
Brooks, Van Wyck........................Westport, Conn.
Cather, Willa........................New York, N. Y.
Cret, Paul Philippe........................Philadelphia, Pa.
Cross, Wilbur L........................New Haven, Conn.
Damrosch, Walter Johannes........................New York, N. Y.
Frost, Robert........................South Shaftsbury, Vt.
Lowes, John Livingston........................Cambridge, Mass.
Lydenberg, Harry Miller........................Scarsdale, N. Y.
Mather, Frank Jewett, Jr........................Washington Crossing, Pa.
Morey, Charles Rufus........................Princeton, N. J.
Morris, Harrison Smith........................Philadelphia, Pa.
O'Neill, Eugene Gladstone........................Danville, Calif.
Phelps, William Lyon........................New Haven, Conn.
Quinn, Arthur Hobson........................Bala-Cynwyd, Pa.
Repplier, Agnes........................Philadelphia, Pa.
Rosenbach, A. S. W........................Philadelphia, Pa.
Schelling, Felix E........................Lumberville, Pa.
Taylor, Deems........................Stamford, Conn.

GEOGRAPHICAL OR PROFESSIONAL LOCATIONS OF MEMBERS

Residents of the United States

Alabama

Perdido Beach
- Patterson, Lamar Gray

Arizona

Flagstaff
- Lampland, Carl O.
- Slipher, Vesto Melvin

California

Berkeley
- Aitken, Robert Grant
- Bolton, Herbert Eugene
- Castle, William Ernest
- Derleth, Charles, Jr.
- Giauque, William Francis
- Kofoid, Charles A.
- Lawrence, Ernest Orlando
- Lawson, Andrew Cowper
- Leuschner, Armin Otto
- Lewis, Gilbert Newton
- Setchell, William Albert
- Tatlock, J. S. P.

Carmel
- MacDougal, Daniel Trembly

Danville
- O'Neill, Eugene Gladstone

La Jolla
- Sumner, Francis Bertody

Los Angeles
- Jennings, Herbert S.

Mt. Hamilton
- Wright, William Hammond

Palo Alto
- Tucker, Richard Hawley

Pasadena
- Adams, Walter Sydney
- Anderson, Carl David
- Bateman, Harry
- Bell, Eric Temple
- Bowen, Ira Sprague
- Gay, Edwin Francis
- Hubble, Edwin P.
- Merrill, Paul Willard
- Millikan, Robert Andrews
- Morgan, Thomas Hunt
- Pauling, Linus Carl
- Seares, Frederick Hanley
- Sturtevant, Alfred Henry
- Tolman, Richard Chace

San Marino
- Farrand, Max

Stanford University
- Blackwelder, Eliot
- Campbell, Douglas Houghton
- Durand, William Frederick
- Hoover, Herbert
- Spoehr, Herman Augustus
- Timoshenko, Stephen P.
- Webster, David Locke
- Willis, Bailey

VALLEJO
See, Thomas Jefferson Jackson

Colorado

BOULDER
Cockerell, Theodore D. A.

Connecticut

BANTAM
Heiser, Victor George

NEW HAVEN
Andrews, Charles McLean
Angell, James Rowland
Brooke, C. F. Tucker
Chittenden, Russell H.
Cross, Wilbur L.
Edgerton, Franklin
Fisher, Irving
Harrison, Ross G.
Henderson, Yandell
Hendrickson, George Lincoln
Phelps, William Lyon
Rostovtzeff, Michael I.
Schlesinger, Frank
Schuchert, Charles
Seymour, Charles
Sinnott, Edmund Ware
Sturtevant, Edgar Howard
Warren, Charles Hyde
Yerkes, Robert Mearns
Zeleny, John

NEW MILFORD
Beard, Charles Austin

OLD LYME
MacCurdy, George Grant

SOUTHPORT
Adams, James Truslow

STAMFORD
Taylor, Deems

WESTPORT
Brooks, Van Wyck

Delaware

WILMINGTON
Du Pont, Francis I.
Du Pont, Pierre Samuel

District of Columbia

WASHINGTON
Abbot, Charles Greeley
Adams, Joseph Quincy
Briggs, Lyman J.
Bush, Vannevar
Cottrell, Frederick Gardner
Cross, Whitman
Day, Arthur L.
Delano, Frederic Adrian
Frankfurter, Felix
Howard, Leland Ossian
Hrdlička, Aleš
Hu Shih
Hughes, Charles Evans
Humphreys, William Jackson
Leland, Waldo G.
Merriam, John C.
Miller, Gerrit Smith, Jr.
Moulton, Forest Ray
Moulton, Harold Glenn
Putnam, Herbert
Roberts, Owen J.
Rowe, Leo S.
Sioussat, St. George Leakin
Stone, Harlan Fiske
Vaughan, Thomas Wayland
Warren, Charles
Wetmore, Alexander
Wright, Frederick E.

Florida

COCONUT GROVE
Barton, George Aaron
McDaniel, Walton Brooks

Ft. Lauderdale
Commons, John Rogers

Gainesville
Coghill, George Ellett

Hawaii

Honolulu
Gregory, Herbert Ernest

Illinois

Chicago
Beeson, Charles Henry
Bliss, Gilbert Ames
Bowen, Norman L.
Buck, Carl Darling
Carlson, Anton Julius
Compton, Arthur Holly
Dempster, Arthur Jeffrey
Franck, James
Harkins, William Draper
Lillie, Frank Rattray
Lillie, Ralph Stayner
Merriam, Charles Edward
Mulliken, Robert Sanderson
Nitze, William Albert
Ogburn, William Fielding
Wright, Sewall

Evanston
Crew, Henry
Mason, William Smith

Urbana
Adams, Roger
Coble, Arthur Byron
Hopkins B Smith
Noyes, William Albert
Trelease, William

Indiana

Bloomington
Cleland, Ralph Erskine

Lafayette
Arthur, Joseph Charles

Maine

Machiasport
Benedict, Francis Gano

Maryland

Annapolis
Scott, James Brown

Baltimore
Albright, William F.
Andrews, Donald Hatch
Berry, Edward Wilber
Bowman, Isaiah
Clark, William Mansfield
Corner, George Washington
Howell, William Henry
Lancaster, Henry Carrington
Livingston, Burton E.
Lovejoy, Arthur Oncken
Reid, Harry Fielding
Robertson, David Moore
Schultz, Adolph H.

Massachusetts

Boston
Byrd, Richard Evelyn
Cannon, Walter Bradford
Castle, William Bosworth
Forbes, Alexander
Joslin, Elliott Proctor
Matthews, Albert
Merrill, Elmer Drew
Minot, George Richards
Reisner, George Andrew
Sprague, Oliver M. W.
Tyzzer, Ernest Edward
Wilson, Edwin Bidwell

Cambridge
Barbour, Thomas
Bailey, Irving Widmer

Bigelow, Henry Bryant
Birkhoff, George David
Bridgman, Percy Williams
Cannon, Annie J.
Chase, George Henry
Compton, Karl Taylor
Conant, James Bryant
Daly, Reginald Aldworth
Ferguson, William Scott
Fernald, Merritt Lyndon
Gaposchkin, Cecilia Payne
Gulick, Charles Burton
Henderson, Lawrence J.
Hisaw, Frederick
Hooton, Earnest A.
Hunsaker, Jerome Clarke
Huntington, Edward V.
Jackson, Dugald Caleb
Keyes, Frederick George
Kidder, Alfred Vincent
Kistiakowsky, George B.
Lamb, Arthur Becket
†Lanman, Charles R.
Lashley, Karl Spencer
Lowell, Abbott Lawrence
Lowes, John Livingston
Lyman, Theodore
McIlwain, Charles Howard
Mark, Edward Laurens
Morison, Samuel Eliot
Osgood, William Fogg
Parker, George Howard
Perry, Ralph Barton
Pound, Roscoe
Rand, Edward Kennard
Sarton, George
Shapley, Harlow
Slater, John Clarke
Tozzer, Alfred Marston
Van Vleck, John Hasbrouck
Wilson, George Grafton

DUXBURY

Bumpus, Hermon Carey

† Deceased.

Michigan

ANN ARBOR

Bartlett, Harley Harris
Bonner, Campbell
Case, Ermine Cowles
Curtis, Heber Doust
Davis, Bradley Moore
Gomberg, Moses
Hobbs, William Herbert
Leverett, Frank
Novy, Frederick G.
Reeves, Jesse S.
Ruthven, Alexander G.
Sanders, Henry A.

Minnesota

MINNEAPOLIS

Ford, Guy Stanton

ST. PAUL

Stakman, Elvin Charles

Missouri

COLUMBIA

Ravenel, Mazÿck

ST. LOUIS

Erlanger, Joseph
Loeb, Leo
Moore, George Thomas

New Jersey

CAMDEN

Johnson, Eldridge Reeves

HOBOKEN

Davis, Harvey Nathaniel

PRINCETON

Adams, Edwin Plimpton
Alexander, James W.
Armstrong, Edward Cooke
Aydelotte, Frank
Buddington, Arthur F
Capps, Edward

Chinard, Gilbert
Conklin, Edwin Grant
Corwin, Edward Samuel
Dahlgren, Ulric
Dodds, Harold Willis
Einstein, Albert
Eisenhart, Luther Pfahler
Fetter, Frank Albert
Harvey, E. Newton
Hulett, George A.
Kemmerer, Edwin Walter
Lefschetz, Solomon
McClure, Charles F. W.
Magie, William Francis
Mather, Frank Jewett, Jr.
Meritt, Benjamin Dean
Morey, Charles Rufus
Morse, Marston
Northrop, John Howard
Robertson, Howard Percy
Russell, Henry Norris
Scott, William Berryman
Shear, Theodore Leslie
Shull, George Harrison
Smyth, Charles Phelps
Stanley, Wendell Meredith
†Stillwell, Lewis Buckley
Taylor, Hugh Stott
Veblen, Oswald
von Neumann, John
Weyl, Hermann

New York

ALBANY

Graves, Frank Pierrepont

COLD SPRING HARBOR

Blakeslee, Albert Francis
Davenport, Charles Benedict
Riddle, Oscar

CROWN POINT

Henderson, Robert

ITHACA

Bailey, Liberty Hyde
Bancroft, Wilder Dwight
Becker, Carl L.
Day, Edmund Ezra
Debye, Peter
Smith, Preserved

NEW YORK

Andrews, Roy Chapman
Armstrong, Hamilton Fish
Baekeland, Leo H.
Berkey, Charles Peter
Boas, Franz
Bogert, Marston Taylor
Bronk, Detlev W.
Butler, Nicholas Murray
Carrel, Alexis
Cather, Willa
Cattell, James McKeen
Chamberlain, Joseph Perkins
Chapman, Frank Michler
Crocker, William
Damrosch, Walter Johannes
Darrach, William
Darrow, Karl Kelchner
Davis, John William
Davisson, Clinton J.
Detwiler, Samuel Randall
Dewey, John
Dinsmoor, William Bell
DuBois, Eugene Floyd
Dunn, Gano
Fermi, Enrico
Flexner, Simon
Fosdick, Raymond Blaine
Gasser, Herbert Spencer
Gies, William J.
Gifford, Walter Sherman
Greene, Evarts B.
Gregory, William King
Guggenheim, William
Harper, Robert A.

† Deceased.

Hawk, Philip Bovier
Hayes, Carlton J. H.
Hazen, Charles D.
Ives, Herbert E.
Jayne, Horace H. F.
Jessup, Philip C.
Jewett, Frank Baldwin
Johnson, Douglas
Keppel, Frederick Paul
Lamont, Thomas William
Landsteiner, Karl
Lydenberg, Harry Miller
McGregor, James Howard
Mitchell, Wesley Clair
Moore, John Bassett
Osterhout, Winthrop J. V.
Paton, Stewart
Prince, John Dyneley
Rockefeller, John D., Jr.
Rous, Peyton
Schurman, Jacob Gould
Shotwell, James Thomson
Simpson, George Gaylord
Stefansson, Vilhjalmur
Taylor, Henry Osborn
Thorndike, Edward L.
Thorndike, Lynn
Urey, Harold Clayton
Van Slyke, Donald Dexter
Willits, Joseph Henry
Winlock, Herbert Eustis
Wissler, Clark
Woodworth, Robert Sessions
Yeatman, Pope
Young, Owen D.

ROCHESTER

Mees, C. E. Kenneth
Murlin, John Raymond
Whipple, George Hoyt

SCHENECTADY

Coolidge, William David
Emmet, William LeRoy
Fox, Dixon Ryan
Langmuir, Irving
Whitney, Willis R.

TUXEDO PARK

Loomis, Alfred Lee

North Carolina

CHAPEL HILL

MacNider, William de B.

Ohio

CLEVELAND

Crile, George
†Miller, Dayton Clarence

DAYTON

Kettering, Charles Franklin

Pennsylvania

BRYN MAWR

Carpenter, Rhys
†Tennent, David Hilt

PHILADELPHIA

deBenneville, James S.
Brubaker, Albert P.
Calvert, Philip Powell
Cheyney, Edward Potts
Cret, Paul Philippe
Dickinson, John
Duane, Morris
Fels, Samuel S.
Fox, Herbert
Gates, Thomas Sovereign
Goodrich, Herbert Funk
Goodspeed, Arthur Willis
Griffith, J. P. Crozer
Haney, John Louis
Hayward, Nathan
Holland, Leicester Bodine
Hopkinson, Edward, Jr.
Huebner, Solomon Stephen

† Deceased.

Jacobs, Merkel Henry
Jenks, John Story
Johnson, Emory R.
Leeds, Morris Evans
Lingelbach, William E.
Long, Esmond Ray
McClung, Clarence E.
Macfarlane, John Muirhead
Mitchell, Howard Hawks
Montgomery, James Alan
Moore, J. Percy
Morgan, Marshall S.
Morris, Harrison Smith
Morris, Lawrence J.
Morris, Roland S.
Norris, George Washington
Norris, George William
Olivier, Charles P.
Packard, Francis Randolph
Patterson, Ernest Minor
†Paul, J. Rodman
Pender, Harold
Penniman, Josiah Harmar
Pepper, George Wharton
Pepper, William
Quinn, Arthur Hobson
Read, Conyers
Repplier, Agnes
Rhoads, Charles James
Richards, Alfred Newton
Richards, Horace Clark
Rolfe, John Carew
Rosenbach, A. S. W.
Rosengarten, Adolph G.
Scattergood, J. Henry
Schaeffer, J. Parsons
Schelling, Felix E.
Schramm, Jacob R.
Scott, John Morin
Singer, Edgar Arthur, Jr.
Wetherill, Samuel Price
Witmer, Lightner
Young, James Thomas

† Deceased.

PITTSBURGH

Foote, Paul Darwin

SWARTHMORE

Dresden, Arnold
Köhler, Wolfgang
Miller, John Anthony
Swann, W. F. G.

Rhode Island

PROVIDENCE

Bryant, William L.
Kraus, Charles August

Texas

AUSTIN

Painter, Theophilus Shickel

HOUSTON

Lovett, Edgar Odell
Wilson, Harold Albert

Vermont

S. SHAFTSBURY

Frost, Robert

Virginia

UNIVERSITY

Beams, Jesse Wakefield
Mitchell, Samuel Alfred

Wisconsin

MADISON

Allen, Charles Elmer
Birge, Edward Asahel
Duggar, Benjamin Minge
Jones, Lewis Ralph
Leith, Charles Kenneth
Stebbins, Joel

WILLIAMS BAY

Struve, Otto

Foreign Residents

Canada

Montreal

Adams, Frank Dawson

Victoria

Miller, Hunter
Plaskett, John Stanley

Mexico

Merida, Yucatan

Morley, Sylvanus Griswold

Denmark

Copenhagen

Bohr, Niels Henrik David

England

Cambridge

Adrian, Edgar Douglas
Dirac, Paul Adrien Maurice
Eddington, Arthur Stanley
Hardy, Godfrey Harold
Hopkins, Frederick Gowland
Larmor, Joseph
Temperley, Harold W. V.

Downe, Kent

Keith, Arthur

London

Beneš, Eduard
Bragg, William Henry
Dale, Henry Hallett
Gooch, George Peabody
Hill, Archibald Vivian
Kenyon, Frederic George
Prain, David
Richardson, Owen Willans
Wilkins, Hubert

Oxford

Evans, Arthur

Shortlands, Kent

Stamp, Josiah Charles

France

Le Cannet

†Ford, Worthington C.

Paris

de Broglie, Louis Victor
Janet, Pierre
de Margerie, Emmanuel
Picard, Emile
Rist, Charles

Germany

Berlin

Penck, Albrecht
Planck, Max

Freiburg

Spemann, Hans

Göttingen

Hilbert, David

Leipzig

Heisenberg, Werner

Vienna

Szombathy, Josef Hofrat

Italy

Rome

Cumont, Franz V. M.
Levi-Civita, Tullio

Kashmir

Srinagar

Stein, Aurel

Norway

Oslo

Hjort, Johan

† Deceased.

Palestine

JERUSALEM
Petrie, Flinders

Scotland

EDINBURGH
Keith, Arthur Berriedale

ST. ANDREWS
Irvine, James Colquhoun

Spain

MADRID
Pidal, Ramón Menéndez

Sweden

LUND
Nilsson, Martin P.

STOCKHOLM
Heckscher, Eli Filip

MEMBERS ELECTED APRIL 19, 1940

CLASS I. MATHEMATICAL AND PHYSICAL SCIENCES

Resident

Ira Sprague Bowen..............................Pasadena, Calif.
William Francis Giauque........................Berkeley, Calif.
Jerome Clarke Hunsaker..........................Boston, Mass.
George Bogdan Kistiakowsky..................Cambridge, Mass.
Robert Sanderson Mulliken..........................Chicago, Ill.
Howard Percy Robertson.......................Princeton, N. J.
John Clarke Slater...............................Cambridge, Mass.

Foreign

Niels Henrik David Bohr..................Copenhagen, Denmark
Sir William Henry Bragg.......................London, England
Tullio Levi-Civita......................................Rome, Italy

CLASS II. GEOLOGICAL AND BIOLOGICAL SCIENCES

Resident

George Washington Corner ....Baltimore, Md.
Samuel Randall Detwiler........................New York, N. Y.
Eugene Floyd DuBois............................New York, N. Y.
Frederick Lee Hisaw..........................Cambridge, Mass.
Esmond Ray Long.............................Philadelphia, Pa.
Elvin Charles Stakman...........................St. Paul, Minn.
Wendell Meredith Stanley......................Princeton, N. J.

Foreign

Pierre Janet...Paris, France

CLASS III. SOCIAL SCIENCES

Resident

Hamilton Fish Armstrong......................New York, N. Y.
Joseph Perkins Chamberlain..................New York, N. Y.
John Dickinson..................................Philadelphia, Pa.

Carlton Joseph Huntley Hayes.................New York, N. Y.
William Fielding Ogburn.......................Chicago, Ill.
Roscoe Pound.................................Watertown, Mass.
Adolph G. Rosengarten........................St. Davids, Pa.

Foreign

Eli Filip Heckscher........................Stockholm, Sweden
Lord Stamp.......................Shortlands, Kent, England

CLASS IV. HUMANITIES

Resident

Joseph Quincy Adams......................Washington, D. C.
Charles Henry Beeson..........................Chicago, Ill.
Charles Burton Gulick......................Cambridge, Mass.
Frank Jewett Mather, Jr...............Washington Crossing, Pa.
Sylvanus Griswold Morley..............Merida, Yucatan, Mexico
Arthur Hobson Quinn........................Bala-Cynwyd, Pa.
George Andrew Reisner.......................Boston, Mass.

Foreign

Franz Valery Marie Cumont......................Rome, Italy
Ramón Menéndez Pidal.........................Madrid, Spain

COUNCIL NOMINEES

Morris Duane..................................Rosemont, Pa.
Morris E. Leeds............................Philadelphia, Pa.

MEMBERS DECEASED DURING 1940

	Date of Election
J. Bertram Lippincott, January 19, aet. 82	1921
Edward S. Harkness, January 29, aet. 66	1934
Samuel M. Vauclain, February 4, aet. 83	1899
William E. Dodd, February 9, aet. 70	1936
Waldemar C. Brögger, February 17, aet. 88	1899
John H. Finley, March 7, aet. 76	1919
John M. Manly, April 2, aet. 74	1912
Cyrus Adler, April 7, aet. 76	1900
Rodney H. True, April 8, aet. 74	1923
Charles L. Reese, April 12, aet. 78	1922
Gustavus W. Cook, June 4, aet. 72	1934
Sir Oliver Joseph Lodge, August 22, aet. 89	1901
Sir Joseph John Thomson, August 30, aet. 83	1903
Raymond Smith Dugan, August 31, aet. 62	1931
Hans Zinsser, September 4, aet. 61	1937
Phoebus A. Levene, September 6, aet. 71	1923
Vito Volterra, October 11, aet. 80	1914
Frank W. Taussig, November 11, aet. 80	1929
Raymond Pearl, November 17, aet. 61	1915
G. Kingsley Noble, December 9, aet. 46	1933

TABLE OF TOTALS

	Resident Members	Foreign Members
December 31, 1939	423	41
Elected during 1940	30	8
Deceased during 1940	16	4
December 31, 1940	437	45

XI
OBITUARY NOTICES

CYRUS ADLER

(1863–1940)

Cyrus Adler, President of the Dropsie College for Hebrew and Cognate Learning, President of the Jewish Theological Seminary of America, was called to the Academy on High on April 7, 1940. It was a rich, eventful career that came to an end in the seventy-seventh year of his life, a career that was singularly distinguished by nobility of thought and utterance and by devoted service to human welfare, especially to the betterment of the lot of his co-religionists throughout the world.

A humble marker, designed by the school children of Van Buren, Arkansas, was recently put up by the local chapter of the Daughters of the American Revolution to commemorate the birthplace of Cyrus Adler. It was there, in that typical American city of Van Buren, that Cyrus was born to Samuel and Sarah Sulzberger Adler on September 13, 1863, during the days of the Civil War. Cyrus was only eight months old when his parents moved East, where his father died shortly afterward. His widowed mother made her home in Philadelphia with her brother, David Sulzberger, and Cyrus grew up a Philadelphian by tradition in an environment dominated by strength of character, learning and piety.

From early childhood, he showed marked religious feeling and a deep interest in Bible studies. For his elementary and secondary schooling he was sent to an interesting type of school that then existed in Philadelphia, a Jewish parochial school under an Episcopalian headmaster, a former British sea captain. While a college student at the University of Pennsylvania, he continued his studies in the Bible, the Talmud and mediaeval Jewish philosophy under a revered teacher, Dr. Sabato Morais, rabbi of the historic congregation Mikveh Israel in Philadelphia. The year that he received the B.A. degree (1883), Johns Hopkins University established the first graduate department in Semitics in America. Adler

eagerly enrolled in the Semitic Seminary under Professor Haupt and was the first to obtain a Ph.D. in Semitics in an American university (1887). He specialized in Assyriology, but his studies embraced the entire field of Semitics, including Arabic, Syriac and Ethiopic. His thesis, entitled "The Annals of Sardanapalus: a Double Transliteration, Translation, Commentary and Concordance of the Cuneiform Text," was never published because of a last minute discovery that the text was then being published in Germany.

With the attainment of the doctorate, Cyrus Adler began a promising career. His rise at Johns Hopkins was rapid, so that three years after his graduation he held the rank of Associate Professor in Semitics. Had he continued in this course, he would undoubtedly have proved a great teacher and one of the leading Semitists of his time. But he was not destined for a sheltered campus life. Immediately upon his graduation from Johns Hopkins, he was appointed Assistant Curator in the United States National Museum in Washington. For a time, he combined this post, which was honorary and on a volunteer basis, with his teaching duties at Johns Hopkins. But as the responsibilities in Washington multiplied, he had to relinquish his post in Baltimore. The expansion of the Smithsonian Institution under Samuel Pierpont Langley, the enlargement of the United States National Museum with the addition of new sections devoted to Oriental Antiquities and later to Religious Ceremonial Institutions, afforded Adler the opportunity to develop his extraordinary talents for administration, organization and statesmanship. After this, he never returned to the confining duties of the classroom.

The twenty years which Adler gave to his work at the Smithsonian were a period of growing maturity and achievement. The departments of Historic Archaeology and Historic Religions in the United States National Museum were almost wholly his creation. He became an ardent exponent of the educational value of museum exhibits and of the rightful place of religion in the great national exhibitions. Above all, he advocated the value of exhibits and expositions as carriers of international good-will and he was successful in bringing about greater representation of the United States Government and American institutions in general at Oriental and allied congresses abroad.

At the Centennial Exposition of the Ohio Valley in 1888, he introduced for the first time an exhibit of Biblical Archaeology and Palestinian Objects. This was the precursor of a series of exhibits which he arranged for the United States Government in Atlanta, Chicago, and St. Louis successively. For the International Exposition in Chicago, he was commissioned by President Benjamin Harrison as a government representative to various Oriental countries in order to present the official invitations to their governments and to secure their participation in the Columbian Exposition. This mission, in which he was highly successful, led him to Turkey, Egypt, Syria, Tunis, Algiers and Morocco. His travels were facilitated by the interest in his mission on the part of the Grand Vizier Kiamal Pasha, with whom he boldly discussed the subject of the restoration of large bodies of Jews to the Holy Land.

Upon his return to Washington in 1892, he was appointed Librarian of the Smithsonian Institution and he held this position until 1905, when he became Assistant Secretary of the Smithsonian Institution. During all these years, Adler was the trusted aide of his chief, Samuel Pierpont Langley, and their friendship was one of the treasures that Adler prized all his life.

Adler's bibliographic record, which was carefully compiled by Coleman and Reider on the occasion of his seventieth anniversary, commences as early as 1882, when he was still an undergraduate student. Beginning with his association with the National Museum, one meets with scholarly contributions from his pen on Oriental antiquities and religious ceremonial objects in the *Proceedings* and the *Annual Reports* of the Museum. He became an important influence in the American Library Association. His support of the International Catalogue of Scientific Literature, which saved the project from utter collapse, is gratefully recorded in the *Annual Report* of the Smithsonian Institution for the year ending June 30, 1909. His discovery of the so-called Jefferson Bible created a literary sensation. It was published, with an introduction by him, in 1904, at the express authorization of Congress and it appeared under the title "The Life and Morals of Jesus of Nazareth, Extracted Textually from the Gospels in Greek, Latin, French and English by Thomas Jefferson. With an Introduction." Washington, 1904. Government Printing Office. When he was asked why he had omitted his own name from the title page, his reply was: "Jesus and Jefferson are sufficient for any title page."

In the midst of his absorbing duties at the Smithsonian he helped establish, in New York, the Jewish Theological Seminary of America and, in Philadelphia, the Jewish Publication Society of America. From his office in Washington he issued a call for the formation of the American Jewish Historical Society. He was editor and prime factor in the production of the *Jewish Encyclopedia*. He led in the reorganization of the Jewish Theological Seminary as a great center of learning in America and in the summoning to these shores of Solomon Schechter of Cambridge fame. Under his guidance, foundations were laid for the library, which was to house the greatest collection of Hebraica and Judaica in the world.

Adler was dynamic in thought, reflective in action. At the core of his being was a vision which steadily grew upon him with increasing clarity and conviction. He was inspired by the thought that America was a land of infinite spiritual possibilities and that here it was possible to create a religious-cultural center of Judaism which should play a rôle in history comparable to its golden age in Spain, Italy and France. He was stirred to a high pitch of enthusiasm by the evidence of a veritable renaissance which he beheld in the Jewry of England. He was strengthened in the conviction that English-speaking Jewry was on the threshold of a great era of spiritual creativeness. To give his powers to this historic process was the absorbing interest of his life—it was the unifying element of his many-sided personality. It was this motive that led him finally to resign his cherished post at the Smithsonian Institution in 1908 in order to head a new institution in Philadelphia, the Dropsie College for Hebrew and Cognate Learning.

The purposes of the founder, Moses Aaron Dropsie, as revealed in the Will and Testament which provided for the establishment of the College, accorded fully with Adler's vision of an American Jewish Academy. The College became the medium through which Adler expressed his own ideals and deepest convictions. There was no set precedent for this type of college—a postgraduate institution in Hebrew and cognate learning leading to the degree of Ph.D.—non-sectarian in character, open to all qualified students without regard to creed, sex or color; free of any theological entanglement and yet serving a profoundly religious purpose in promoting a deeper knowledge of the sources of religion. Adler had a free hand in the design of the College: every detail of its planning emanated from his brain. It is the living embodiment of his spirit. In the

thirty years of its existence the College, through its faculty and the corps of scholars and research students which it has trained, and its scientific quarterly and other publications, has made its influence felt in all parts of the world where Jewish learning is a living ideal.

While he was engaged in organizing the work of the Dropsie College, Adler headed a monumental project sponsored by the Jewish Publication Society of America to create a new, authoritative translation of the Bible in English from the viewpoint of Jewish scholarship. It was nobly conceived as a product of the Jewish consciousness on a par with similar creations of the Catholic and Protestant churches. The Board which Adler headed consisted of seven editors who represented various shades of religious opinion in Judaism. The work of translation covered a period of seven years (1908–15). When completed, the new Bible represented not only a monument of Hebrew scholarship: it opened the gateway of Jewish tradition in the interpretation of the Word of God.

Hardly had this task been performed, when Adler was at work in planning another ambitious undertaking, the publication of the Schiff Library of Jewish Classics, similar to the Loeb series of Greek and Latin classics. The World War interrupted the execution of the project, but after an interlude of several years the plan was put into operation. Seventeen handsome volumes have thus far been published containing critically edited texts of various branches of mediaeval Hebrew literature, with carefully prepared translations, a work into which scholars had to be drawn from many parts of the world. It will be many years before the full design of Dr. Adler's broadly conceived plan will be carried out.

This brief sketch is primarily concerned with Dr. Adler's scientific and literary activities. The limitations of space do not permit us to enter upon the significant rôle he played as a statesman in defense of the civil, political and religious rights of his coreligionists in many parts of the world wherever they were threatened.

The War and post-War conditions brought ruin and destruction upon countless Jewish communities in Central and Eastern Europe and Adler did heroic work in helping to sustain their morale during those terrifying years. He played an important rôle in the interests of his people and of minority peoples in general at the Peace Conference in Versailles. Ten years later when Arab riots broke out at the Wailing Wall, Adler accepted the call of the League of Nations to prepare a "Memorandum on the Western Wall" for

the consideration of the Special Commission that had been appointed to study the question.

In addition to his cultural contributions, Cyrus Adler holds an historic place in the religious development of American Judaism. He was an exponent of the traditional historical movement, best known as Conservative Judaism. He helped to crystallize this religious tendency both in its theoretical interpretation and in practical organization. It was a signal distinction when, upon the death of Dr. Solomon Schechter, the eminent divine and leading rabbinical scholar of his day, Cyrus Adler, a layman without rabbinical ordination, was elected his successor and became President of the Jewish Theological Seminary of America.

In 1925, the Hebrew Union College conferred upon him, *honoris causa*, the degree of Doctor of Hebrew Literature. The University of Pennsylvania honored him with the degree of Doctor of Literature in 1930. Many other distinctions crowned his career. He was deeply moved when on December 23, 1939, he was summoned by the President of the United States as the outstanding Jewish religious leader to confer with him and with the religious dignitaries of the Catholic and Protestant churches to help formulate a program for the coming of the day when peace would be re-established in the world.

Dr. Adler's relation to the American Philosophical Society extended over a period of forty years. Elected to membership May 18, 1900, he served on the Council from 1927–30 and 1932–36. He was active as a member of the Committee on Publications from 1932 and of the Committee on Meetings from 1936 to the time of his death. He played a prominent part in the arrangements for the Bicentenary Celebration of the Society in 1927 and delivered a felicitous address at the Bicentenary Banquet when to him fell the honor of voicing the sentiments of the Society on the occasion of its two hundredth anniversary. He was elected Vice-president in 1938 and held this office at the time of his death.

President Franklin D. Roosevelt's tribute to Dr. Adler will find an echo in the hearts of countless men and women of many faiths and many lands: "Scholar, patriot, humanitarian and religious leader who held fast to the ancient verities, an earnest worker in the cause of peace and advocate of good will among men."

Abraham A. Neuman.

GUSTAVUS WYNNE COOK

(1867–1940)

In America, it is worthy of note that astronomy has been able to make its advances so largely by the generosity and foresight of men in no direct way connected with the institutions they endowed. Practically all the great observatories in the United States are gifts to the universities or colleges at which they are located. Within the past generation or two, however, many men, interested as amateurs, have founded and maintained their own observatories. These ranged from the famous Lowell Observatory, at which such outstanding work has been done, to modest buildings which house very small telescopes and whose existence is known only locally. In recent years two more excellently equipped private observatories, the McMath-Hulbert in Michigan and the Cook in Pennsylvania, have been established and used to great scientific advantage by their founders.

Gustavus Wynne Cook, the subject of this brief sketch, was a native of Philadelphia, born December 12, 1867, and his long, useful and eventful life was spent in and around this city, with which he was closely identified by many business, social and scientific interests. He died at his home, Roslyn House, in Wynnewood, on June 4, 1940. His father, Richard Y. Cook, had been an outstanding banker and business man in Philadelphia, and his son, after receiving his education at Eastbury Academy and later attending night classes at the Franklin Institute, followed his father in a business career in which he became eminently successful. In 1895 his marriage to Miss Nannie Mumford Bright of Williamsburg, Virginia, took place. Mrs. Cook and two daughters, Mrs. Alfred Putnam and Mrs. L. E. Wright, and four grandchildren survive.

His interest in astronomy began at an early age, and, despite all the pressure and distractions of a busy life, constantly grew to its very close. When he lived in the city of Philadelphia as a young man, he had a telescope mounted on the roof of his home, and in later years, after he had acquired Roslyn House at Wynnewood, this telescope was carried there. A permanent building was later erected in which a fine 8-inch refractor was mounted and in this it may be considered that the Cook Observatory was founded. Not content with one instrument, he designed and constructed, in his

private workshop, a fine 3-inch transit of the elbow type, for the determination of time, and began the acquisition of the numerous clocks which are part of the observatory's equipment. About 1932, he determined to expand his outfit and the first step was the acquisition of a 28½-inch reflecting telescope, which can be used as either a Newtonian or Cassegranian. A two-prism spectrograph was made for this by J. W. Fecker, who also constructed the telescope itself. To use the 28½-inch with regularity, Dr. Orren Mohler was placed on the staff, and until his resignation in 1940, he carried out a large and valuable program of spectroscopic work.

Other instruments now there include a 15-inch horizontal refracting telescope, the lens fed by a large coelostat. This mounting permits the observer to sit in comfort in a warm room, a luxury few astronomers are ever permitted. An astrographic mounting carries three cameras: two have lenses of 4 inches and 5 inches respectively; the third has two lenses, either of which can be used, one of 6½ inches, the other of 10¼ inches aperture. The clock-drive is electrically controlled by a special device designed by Mr. L. P. Tabor of the staff, which gives an accuracy of the highest order. There is also a combined spectroheliograph and spectrohelioscope, designed by Mr. I. M. Levitt of the staff, used in connection with a 40-foot focus solar camera. It will be noted that Dr. Cook had the wisdom to encourage originality in the men by whom he surrounded himself. A 10-inch Schmidt camera, which arrived shortly before his death, completes the main equipment and makes the Cook Observatory not only outstanding among the few large observatories owned by amateurs but makes it compare very favorably with all in the country with the exception of a very few belonging to the largest institutions.

Dr. Cook, aided by a staff of four men, undertook valuable programs of work. This is in marked contrast to some other private observatories in which the instruments serve only for the amusement of owner and friends and in which no real work is ever done. Dr. Cook's most ambitious scheme was to photograph the Milky Way with the 10½-inch astrographic camera, using 20 x 24 inch plates; when completed this Milky Way Atlas will be the most valuable one in existence. Over half the plates were taken while Dr. Cook was living; it is hoped the others can be secured within a year.

Three years ago Dr. Cook spoke to the writer of his desire to have his observatory continue its work and his probable intention of willing it to the University of Pennsylvania. No official action was taken at the time, however, except that a report was submitted to him which showed the eventual needs should such a bequest be made. Dr. Cook nevertheless carried out his plans and the Cook Observatory and the Flower Observatory will henceforth constitute two units of the same Department of Astronomy. It was his expressed hope and is indeed the intention of the authorities of the University to secure a more suitable site in the future at a distance from the city and to move the combined equipment of the Cook and Flower Observatories to this favorable location. Meantime, by the kind permission of Mrs. Cook, the present location of the Cook Observatory is to be occupied until other plans can be made. In any case Dr. Cook's name will be perpetuated in connection with the observatory he founded.

The honorary degree of Doctor of Science was conferred upon Dr. Cook in 1937 by the University of Pennsylvania in recognition of his eminent contributions to science. He was a member of a large number of clubs and organizations as well as of numerous scientific societies including the American Astronomical Society and the American Association for the Advancement of Science; his election to the American Philosophical Society took place in 1934. Dr. Cook's business career included the presidency of the South Chester Terminal and Warehouse Company and of the South Chester Tube Company, membership on the board of directors of several banks and trust companies, besides many other commercial and business connections. His health began to fail five years before his death, and for the last two years was so impaired that he had to give up many of his business activities as well as much of his astronomical work. A member of the Episcopal Church, Dr. Cook took a great interest in the work of the parish in which he resided.

The fine arts profoundly interested him; he played both violin and piano excellently, and painted well in water colors, his favorite subjects being marine scenes. In his splendidly equipped machine shop at his home he made instruments of precision, and also beautiful models of ships, a number of which adorn the walls of the Cook Observatory. Photography was another of the pursuits in which he attained real skill. His library contained many most rare and valuable old scientific books and documents. These were willed to

the Franklin Institute. At Roslyn House he had a large greenhouse and gardens of lovely flowers, in the cultivation of which he took much pleasure. Scientists, however, will remember him especially as a charming and genial host. For many years, whenever he chanced to learn of the presence in the vicinity of a visiting astronomer, he gave, if possible, a delightful dinner party at his home. To these were invited not only local scientists but many of his wide circle of friends. He was most generous in putting the resources of his observatory at the service of others, and many benefitted by this. He was indeed a most human person, one who took interest in the lives and problems of others, and his passing will be a cause of deep regret to many who had the privilege of knowing him. It is earnestly hoped that in years to come the work of the observatory founded by him will continue to be a fitting memorial to this man who made so many useful contributions to the period in which he lived.

CHARLES P. OLIVIER.

WILLIAM EDWARD DODD

(1869–1940)

At Clayton, North Carolina, in that southland whose history was later to be his chosen theme, William Edward Dodd, the son of John D. and Evelyn Creech Dodd, came into the world October 21, 1869. The tragedy of Reconstruction was still part of the daily life of his parents, and pervaded the atmosphere which he himself breathed in his early years. Fate delayed his graduation from the Virginia Polytechnic Institute until he had passed the customary age of a college graduate and had reached his twenty-seventh year. Finding himself at home in the calling of the scholar he began to teach history. In 1900 he had won the degree of Doctor of Philosophy from the University of Leipzig and from his residence in Germany had become filled with a deep interest in the people of that country. This was as the century closed and Dodd reached his thirty-second year. In 1901 he was married to Martha Johns of Auburn, North Carolina, who gave him a son and a daughter.

The topic which Dodd had chosen for his Leipzig dissertation—the return of Jefferson to politics in 1796,—expanded in the eight years in which Dodd was Professor of History at Randolph-Macon College in Virginia, and indeed throughout his whole life, into an

intensive study of the careers of political leaders in the southern states of the United States and the economics and politics of the South. Perhaps no one of the men of whom Dodd was to write came so close to his heart as Nathaniel Macon whose biography he published in 1903. More ambitious was the "Life of Jefferson Davis" (1907), in the series called *The Crisis Biographies*. The work which Dodd had done in preparing this volume was available for the delightfully written little book of four years later, which he called "Statesmen of the Old South." When this was published in 1911, Dodd had already been for three years Professor of American History in the University of Chicago; and there, for a quarter of a century he wrote, edited, and taught. In 1915, he was editor of the series *The Riverside History of the United States* for which he himself wrote the volume "Expansion and Conflict," a thoughtful and thought-provoking study. A similarly striking contribution was made four years later to Yale's *Chronicles of America*, in his "The Cotton Kingdom."

Like many another upon whose enthusiasm economic necessity has laid the burden of teaching, Dodd, while he wrote much that was stimulating and suggestive, put most of his energy that might have been creative into his instruction. To Dodd this meant not so much pouring into set moulds ideas of his own, as extracting ideas from the minds of the younger men and women who explored under his guidance the buried treasures to be found in the newspapers, letters, court records, accounts, and other sources of a past generation. Thus at Chicago Dodd became an influence in that he founded a school of men and women farthest in their intellectual make-up from anything like an orthodox pattern; a school in which questioning and criticism were the rule, though these were not untouched by sentiment, for Dodd, in what he wrote of the Old South disclosed a conflict of feelings within himself which reflected the complexity of the opposing currents that marked the South in the period of whose history he was the master. On the one hand his readers can hardly fail to be conscious of an accent of lament for the passing of the old régime; on the other Dodd appears unmistakably as a critic of that régime. Perhaps the explanation lies in the fact that Dodd's ancestral stock was rather that of the small farmer, up-country southerner than that of the large slaveholder of the tidewater. Southerner he was in his opposition to centralization and industrialism. Perhaps he did not allow his

mind to become too logical. If sometimes anti-southern in his premises, on the whole he came out southern in his conclusions.

So much for Dodd as the historian of the Old South, but while he was writing his "Expansion and Conflict" he saw that country in which his formal education had been completed change from the Germany of the 19th century into that of the World War. In his native land he beheld the rise of a statesman of the new South who became the Messiah of a new world order. When that statesman entered into the darkness of apparent failure Dodd, who had been willing to be an apostle, saw it to be his part once more to turn biographer. His book "Woodrow Wilson and His Work" which appeared in 1920 was one of the earliest serious efforts to appraise the great Democrat and the founder of the League of Nations. Dodd had not forgotten the Old South and the war of 1861, as he showed when he wrote in 1928 his "Lincoln or Lee;" but this was not published until some time after Dodd had edited, with Ray Stannard Baker, "The Public Papers of Woodrow Wilson." Here was the height of Dodd's career as an historian; and his attainments were recognized when the American Historical Association in 1934 made him its President. The American Philosophical Society elected him to membership on April 24, 1936.

The forces which had caused the overthrow of Woodrow Wilson in their turn gave way to the election of another Democratic President. At his hand Dodd was called from the academic environment which had always been his into the service of the Government as the diplomatic envoy of democratic America to the people of that Germany which Dodd had known in his younger, formative years. He stood before Hitler and his régime in the ultimately unreconcilable rôles of the ambassador of a friendly power and of a remorseless critic of Germany's government and Germany's new ideology. When his task became impossible, he returned to this country and wore himself out in the effort to make America conscious of the danger to itself in Hitler's domination of Europe. But, added to domestic sorrow and the shock of a disastrous automobile accident, ill-health laid an increasing load upon him, and culminated in a pneumonia which closed his life on February 9, 1940, at his country home, Round Hill, Virginia.

St. George L. Sioussat.

RAYMOND SMITH DUGAN

(1878–1940)

Raymond Smith Dugan, Professor of Astronomy in Princeton University, was born in Montague, Mass., on May 30, 1878. His interest in astronomy began while an undergraduate at Amherst (where he received his A.B. degree in 1899), was continued for three years at the Syrian Protestant College in Beirut (where he served as Instructor in Mathematics and Astronomy) and three years more under Max Wolf at Heidelberg—which University granted him its Ph.D. in 1905.

In that year he began the connection with Princeton which lasted the rest of his life, and the investigations on eclipsing variable stars which made him a leading authority in this field. The 23-inch equatorial at Princeton had the usual characteristics of Alvan Clark's work—the highest excellence in its optical parts, but a lower standard in the mechanical mounting—at least according to the exacting requirements of modern work. Photographic or spectroscopic researches were hardly inviting with this equipment; but it was quite suitable for visual photometry, since a Pickering polarizing photometer had been obtained a few years before, which still ranks as an instrument of high precision.

Preparing for a long campaign of precise observation, he showed sound judgment by selecting stars whose light-variations repeated themselves accurately—so that reliable mean light-curves could be found—and arose from a known cause—so that a theoretical discussion of these light-curves, commensurate with the heavy labor spent in obtaining them, was possible.

The work was heavy enough—he made as many as 18,000 photometric settings on a single star—but the results fully justified it. It had long been known that, from accurate observations of the eclipses, the relative sizes and the densities of the components could be determined, but Dugan found, for the first time, evidence that the side of the faint companion turned toward its primary, and heated by it, is brighter than the other, and also that distortion of the stars into ellipsoids by their mutual tidal attraction, is not confined to a few close systems, but is observable in almost all.

Many eclipsing systems show variations of period. In a few of them this arises from the rotation of the line of apsides of an eccentric orbit, under the attraction of the tidally distorted stars.

From the rate of this motion, reliable information—otherwise wholly inaccessible—may be derived regarding the concentration of density toward the centers of the stars. The first full discussion of such a system—Y Cygni—depends largely upon Dugan's observations.

For most of these stars the variations in period cannot be thus explained. His last published work dealt with this phenomenon, but did not suffice to find its origin, providing, however, invaluable material for future investigators.

His work was recognized by his election to the American Philosophical Society on April 24, 1931, and by membership on the Commission on Variable Stars of the International Astronomical Union—of which he was Chairman from 1935 until his death—and by his re-election, from year to year, as Secretary of the American Astronomical Society. He was an excellent teacher, especially of advanced students, and showed excellent administrative ability on the many occasions in which he was Acting Director of the Observatory at Princeton.

He was of a somewhat retiring disposition, but those who knew him were delighted by a dry humor—a product of both his Irish and his Yankee ancestry, which crop out often in his reports of scientific meetings—and deeply impressed, in later years, by his courage. In 1935 he was attacked by arthritis, which put an end to his beloved observing, and later nearly crippled him. He continued his teaching—literally from an arm-chair—and the discussion of his own and others' observations, until, in the spring of 1940, his strong constitution gave way. He died on August 31 of this year. His widow and two adopted children survive him.

Henry Norris Russell.

LIVINGSTON FARRAND

(1867–1939)

Livingston Farrand was born on June 14, 1867, in Newark, New Jersey. He received his early education in the Newark Academy, of which his father was headmaster, and spent a year in business before entering Princeton University, from which he graduated in 1888. He then attended the College of Physicians and Surgeons in New York City, receiving the degree of M.D. in 1891. The increasing interest which the study of physiological psychology was at

that time receiving, especially in England and Germany, led Dr. Farrand to choose for specialization this subject, rather than the practice of medicine, and in preparation he spent two years in graduate study abroad in the Universities of Cambridge (1891–1892) and Berlin (1892–1893).

On his return to the United States, he joined the faculty of Columbia University. In the autumn of 1893 he became Instructor there in Physiological Psychology, in 1899 Instructor in Psychology, and in 1901 Adjunct Professor of Psychology. Meantime his interests were again taking a new direction; in 1903 he was appointed to the chair of anthropology, a position he held until 1914.

Soon after its formation in 1904, Dr. Farrand was made Executive Secretary of the National Association for the Study and Prevention of Tuberculosis. This was the first work he did in connection with welfare and philanthropic organizations, in the service of which his medical training and his extensive experience in dealing with problems of physiological psychology, psychology, and anthropology, were to prove so ideal a foundation. Under his nine-year administration of this office, branches of the tuberculosis association were formed in every state of the Union and in our island possessions; enrollment in the National Association rose from 500 to 2256 members; and there was a corresponding increase in special tuberculosis hospitals, dispensaries, sanatoria, and open air schools. The difficult question of providing financial support for all these was solved when he induced the Red Cross to turn over to tuberculosis work the entire income from the Christmas Seals; this provided a generous support and the seal itself carried with it, even to the humblest home, a sympathetic message of health and of the need of preventing the disease.

In 1914 Dr. Farrand resigned from Columbia to become President of the University of Colorado. During the five years that he served there, he worked energetically to revivify this institution and to establish its medical school on a sound basis. Soon his influence was felt far beyond the University, as is evidenced by the fact that he played a leading rôle in bringing to satisfactory settlement bitter labor disputes throughout the State of Colorado.

In 1917 the University of Colorado granted Dr. Farrand leave of absence to assist in war work. On account of his previous success in organization and his unique personal qualifications in dealing with difficult situations, he had been selected by the Rockefeller

Foundation as the most suitable man to head the Commission it was sending abroad to assist the French in their attempt to control tuberculosis. In undertaking this mission, he knew he would be severely handicapped by an unfamiliar language and by the suspicions which France felt of all foreign offers; he was well aware, also, that America had little to teach the land of Pasteur regarding the nature of tuberculosis. He is quoted as saying to President Poincaré, "We are not here to give you instructions, but to fight with you against a common enemy." Through his tact, wisdom, and statesmanship, and especially through his sensitiveness in understanding the attitude of those with whom he dealt, in less than two years he had established the French Anti-Tuberculosis Association and had won for the Commission the complete confidence of the French people. In recognition of his accomplishment, the French Government made him Officer in the Legion of Honor; twenty years later, he was made Commander. Among the distinguished achievements of Livingston Farrand, his contribution to the cause of tuberculosis control is perhaps the most striking.

From the beginning of the war, Dr. Farrand had been in close touch with the American Red Cross, which drew him to its service even during his work in France. Many months before the armistice, members of the War Council of the Red Cross had determined to spare no effort to preserve for time of peace the efficiency and high morale achieved in their work in time of war, and had been looking for a wise and vital leader who could hold together the forces of the Red Cross until these could be redirected to new and useful purposes. Dr. Farrand was the first and only choice of the Council for this work and on their recommendation President Wilson appointed him Chairman of the Central Committee, to take charge on March 1, 1919. Mr. Eliot Wadsworth, Acting Chairman of the Red Cross, recently made the following statement: "The Red Cross today stands on the foundation so wisely designed and constructed by Dr. Farrand in the three critical years following the war. His wise knowledge of the problems of public health and social welfare enabled him to plan and develop a programme which did not conflict with existing agencies in these fields. His leadership maintained the high spirit of service, which, during the war, had made the Red Cross a great constructive force both nationally and internationally. He brought to the organization three priceless qualities—a keen sense of humor, an unusual ability to plan

and organize, and dauntless enthusiasm which overrode all obstacles."

Dr. Farrand was called to the presidency of Cornell University in 1921. Under his administration of sixteen years, the University moved forward in substance, prestige, and influence. It was an organization of great complexity, comprising four state institutions, five endowed colleges, and a graduate school; but his fair-mindedness and magnanimity, his easy persuasive speech, and his engaging and disarming humor, enabled him to administer these with consummate tact, equity, and integrity. He accomplished the task of uniting two strong but separated forces in New York City—the Cornell Medical School and the New York Hospital—into one great project devoted to medical education, service, and research; and one of the last of the many distinctions bestowed on Dr. Farrand was his appointment to membership on the Board of Governors of the New York Hospital, the first physician to be so recognized in one hundred and twenty-three years. Dr. Albert R. Mann, who served with Dr. Farrand, first as Dean of the New York State College of Agriculture, and later as Provost of Cornell University, states: "Dr. Farrand's remarkable clarity of thought and expression, his sagacity and broad understanding, his manifest objectivity and his warm personality and unusual charm endowed his leadership of faculty and trustees with the confidence and devoted support of his associates. Courage, kindliness, and resourcefulness never failed him. These fortunate attributes, enriched by a contagious spirit and spacious sympathies, made his influence felt throughout the University. To an extraordinary degree, giving himself without reserve, he entered into the lives and activities of undergraduates, faculty, trustees, alumni, and the Ithaca community in which Cornell University is so happily placed. Cornell and Ithaca came to love this man deeply."

Some of the other positions held by Dr. Farrand show the wide scope of his interests and influence. He was a member of the Technical Board and of the Board of Trustees of the Milbank Memorial Fund; member of the Public Health Council of the State of New York; trustee of the American Museum of Natural History; Chairman of the Board of Trustees of the Carnegie Foundation for the Advancement of Teaching; Chairman of the World's Fair Committee on the Hall of Man; Director of the American Museum of Health. He was the recipient of eighteen honorary degrees from

colleges and universities; he became a member of the American Philosophical Society in 1924.

Shortly after Dr. Farrand's death, which occurred on November 8, 1939, a memorial meeting was held in the New York Academy of Medicine, in recognition of his great service to humanity; on this occasion addresses were delivered by eleven speakers, representing twenty-two organizations and institutions with which Dr. Farrand had been closely associated. The memorial booklet containing these speeches pictures Livingston Farrand as the great public benefactor, the great educator, and the great gentleman that he was; they show that his personality was as perfect in its quality as his life was rich in accomplishment, and place him among the most eminent Americans of his time.

CHARLES F. W. MCCLURE.

PHOEBUS AARON THEODOR LEVENE

(1869–1940)

Dr. Levene was born at Sagor, Russia, on February 25, 1869; he died in New York on September 6, 1940. His higher schooling was obtained at the Classical Gymnasium and at the Imperial Military Medical Academy, St. Petersburg. He was especially attracted to chemistry during his medical studies, and this bent was encouraged by his teachers, Borodin and Dianin. Pavlov was a *privat docent* in physiology at this time, and Levene came also under his influence.

In New York, whither the Levene family migrated in 1891, Dr. Levene enrolled as a special student in chemistry in the School of Mines at Columbia University. At later times he spent periods of study under such masters of chemistry as Drechsel in Berne, Kossel in Marburg, and especially Emil Fischer in Berlin.

Levene was a pioneer in biochemistry in its fundamental forms in this country. In 1896 he became associated with the New York State Pathological Institute, and in 1905 he was one of a small group of laboratory workers in the newly opened laboratory of the Rockefeller Institute for Medical Research in New York. In the temporary building in which the Institute started work, Levene was given a room with a servant as helper. This beginning marked Levene's definite entry into biochemical research, a step destined to make his name known and respected wherever that science is cul-

tivated. In time a modern chemical laboratory was placed at his disposal and students came to him not only from the Americas, but also from Europe and the Far East.

Nature had fitted Levene well for the part he was to play in advancing knowledge in biochemistry. He was a born investigator, a superb teacher: he possessed exceptional versatility and was fertile in ideas. With all these qualities he combined the artistic temperament so valuable to the chemist, who seeks perfection in his finished work. Moreover, he was an excellent linguist, having a reading and speaking knowledge of all the main European languages, so that the chemical literature of the whole world was at his immediate disposal; as a voracious student, he made full use of it.

In the thirty-five active years at the Rockefeller Institute—and he never ceased working with his own hands in the laboratory up to the end of his life—more than seven hundred papers, monographs, and summaries issued from his laboratory, the work of his pupils and himself. This scientific work was in the forefront of the biological problems which engaged the leading organic chemists of the period, the subjects investigated including the proteins, the carbohydrates, the lipoids, the nucleic acids, and the glycoproteins. In addition to these main themes there should be added his stereochemical investigations and studies made upon the enzymes, particularly the nucleases and the peptidases, and the hormones, as in the instance of vitamin B_1.

Honors came to Levene, of course. The two he prized most were conferred on him by his peers in chemistry. In 1931 he was the recipient of the Willard Gibbs Medal of the Chicago Section of the American Chemical Society, and in 1938 of the William H. Nichols Medal of the New York Section of that society. Dr. Levene was elected a member of the American Philosophical Society on April 21, 1923, and served on the Committee on Meetings, 1939–1940.

SIMON FLEXNER.

J. BERTRAM LIPPINCOTT

(1857–1940)

On January 19, 1940, following an attack of pneumonia, Joshua Bertram Lippincott, dean of American book publishers, and for nearly twenty years a member of the American Philosophical So-

ciety, died at his town house, 1712 Spruce Street, Philadelphia. In his passing, at the age of 82, Pennsylvania lost not only one of its outstanding citizens but also one whose charm and kindly personality had endeared him far and wide.

He was born on August 24, 1857, at his father's summer home in the Huntingdon Valley, but spent a large part of every year of his life in Philadelphia where he devoted himself more and more to the various enterprises which he believed contributed to the city's economic, educational, political, charitable and social growth.

His early training was at The Episcopal Academy from which he graduated in 1874 to enter the Class of 1878 of the University of Pennsylvania. His father, Joshua Ballinger Lippincott, had become a trustee of the University in 1876, and besides taking special interest in its library, had been one of the founders of the School of Veterinary Medicine. J. Bertram Lippincott took up his father's interests and on February 3, 1903, was elected a Trustee, and in 1906 President of the Board of Managers of the Veterinary Hospital. When in 1931 the University established the Board of Medical Affairs, he was made a member, *ex-officio*. In 1906 the University of Pennsylvania conferred upon him the degree of Bachelor of Arts, and in 1935, on the occasion of the 50th anniversary of the establishment of the school of Veterinary Medicine, presented the honorary degree of Doctor of Laws.

As evidence of his great interest in animals, he raised on his farm in Montgomery County thoroughbred horses, sheep, Holstein and Jersey cattle and fancy breeds of poultry, as well as field crops along experimental lines. For years he was leader in the Philadelphia Society for Promoting Agriculture which held many of its meetings at his home.

In one of the newspapers of that day appears the following characteristic account: "His stud farm of Clydesdales at Bethayres has national fame. Whether amid the intricacies of an immense business or relaxing amid the pleasures of a country gentleman's rural life, Mr. J. B. Lippincott is always the soul of courtesy and kindliness and consequently immensely popular."

Mr. Lippincott left college to enter the publishing business of his father, together with his two older brothers, Craige and Walter. At an early age he went to London to study the English book business, and in 1884 he was admitted to the firm of J. B. Lippincott & Co. In 1886 he became Vice-president, and in 1910 the President.

This latter office he relinquished in 1926 to become Chairman of the Board, a position he held until his death. The company during his lifetime published millions of volumes on medicine and surgery, science, educational subjects and in all branches of general literature. *Lippincotts Monthly Magazine* will long be remembered; other periodicals published under his supervision included *The Annals of Surgery, International Clinics* and *The Digest of Treatment.*

His connections outside of publishing were many. In 1895 he became a director of the Bethlehem Iron Works, and in the same year of the Academy of Music (of which later he was made Vice-president), in 1902 of the Mercantile Library, the presidency of which he held several years before his death. In 1909 he was elected a director of the Farmers and Mechanics Bank, succeeding George C. Thomas. He also served as a director of the Board of Trade and of the Athenaeum Library.

On April 22, 1885, he married Joanna Wharton, eldest daughter of the iron and steel magnate, Joseph Wharton. When The Wharton Steel Co. was incorporated in New Jersey with a capital stock of $10,000,000, he became Vice-president. He was elected a member of the American Philosophical Society on April 23, 1921, and was appointed a member of the Committee on Hall in 1922. In 1924 he was elected chairman of this committee and in this capacity he served on the Council from 1924 to 1940. He was also a member of the Committee on Finance from 1923 to 1932. For thirteen years (1926–39) Mr. and Mrs. Lippincott entertained at dinner in their hospitable home the Officers and Council of the Society during the Annual Meeting in April. This dinner meeting of the Council had come to be looked forward to as one of the most enjoyable events of the Annual Meeting, and none of those who were ever present can forget the gracious hospitality of those perfect dinners.

His clubs included The Players, Publishers' Lunch, Bachelors Barge, Art, Corinthian Yacht, University, Country Club, Huntingdon Valley, Union League and Franklin Inn. Of the Union League he was a director 1905–1907. Of the Franklin Inn Club he was one of the founders, and chairman of the meeting at which its first president, Dr. S. Weir Mitchell, was elected.

Each summer he spent at his house on Conanicut Island, Narragansett Bay, from which he took extended yachting trips. In the autumn he lived at "Melmar" Bethayres, in the winter at his

house, 1712 Spruce Street, where among many entertainments he gave a number of Wistar Parties. At least two weeks each winter he spent at his shooting lodge in Clay County, Florida.

Besides writing on aspects of publishing, he gave many addresses on a variety of subjects, among them "Publishing as a Profession," delivered before the Wharton School of the University of Pennsylvania, and "The Novel from the Standpoint of the Publisher," before the Contemporary Club.

His close friends included countless celebrities, and his hospitality appeared to know no end. He and Mrs. Lippincott celebrated their fiftieth wedding anniversary in 1935 with their four children and their seventeen grandchildren all present.

An athlete and first class oarsman in his youth, Mr. Lippincott remained active in civic and business affairs up to the time of his sudden illness.

John M. Scott.

JOHN MATTHEWS MANLY

(1865–1940)

The American Philosophical Society, like many other learned associations and numberless individuals, has reason to be sorry for the loss of John Matthews Manly, scholar and teacher of scholars. He died at the age of seventy-five, on April 2, 1940. After his formal education at a southern college of which his father was President, and at Harvard, and after minor teaching positions, he was Professor at Brown 1891–8, at Chicago 1898–1940 (mostly as Head of the English Department, latterly as emeritus), and on exchange in 1909 at Göttingen; to say nothing of many kinds of professional honors in two continents.

His publications are notable not only for their number, originality and erudition but for their variety. A considerable proportion, some of the most important, are on Chaucer, a few are linguistic, many are on the early drama, some on Shakespeare, some specially well known on *Piers the Plowman*. These are "close scholarship," on literary history and interpretation for days long gone by which call for learning and the historical imagination. But Manly like some other eminent scholars also felt the call to make his learning, taste and judgment more widely useful by producing text-books for younger students, usually in collaboration

with experienced teachers, even on such unlikely-seeming subjects as business-English and advertising. Noteworthy among his text-books is "English Poetry (1170–1892)," about the earliest of the flood of selections from poetry for young college students, and what is more one of the best anthologies of any kind known to the present writer, a fruit of his immensely wide and rapid reading.

His most imposing work of close scholarship is "The Text of the Canterbury Tales," in eight volumes, which he had the satisfaction of seeing published only a few months before his death, after some fourteen years of skilfully planned labors. This contains an entirely fresh text of one of the two earliest great poems in English, based on all of the eighty-five (or so) known MSS, and what is even more important, also a description and study of all of these, their history and relations, and a complete *corpus* of all the variant readings in all of them, and much besides. This gigantic task could have been put through only with a corps of devoted assistants, chief of whom was the eminent scholar Edith Rickert, and a large amount of money, much of which went for photographs of all the MSS. Manly was good at raising money for such causes, and probably had few such rebuffs as when a rich woman said to him, "I'm not interested in old manuscripts, and I don't see why you or anybody should be." Of appeal no greater but less technical is "Some New Light on Chaucer" (1926), which chiefly shows how many people were alive in the poet's day who resemble the Pilgrims in his great work. Whether or not the reader shares Manly's evident opinion that Chaucer often portrayed actual people when he wrote the *Prolog*, the reader gains an idea more vivid than before of the poet's love of reality. Still more debatable perhaps, but exceedingly keen, learned and original, are his studies of the authorship and history of that wonderful compound of ideality, imagination, *saeva indignatio*, savorous language, searchlight eye,—*Piers the Plowman*. Such as these are the many products of Manly's immense mental activity, his germinal mind. He did not expend it on trifles, nor on mechanical work, nor even on a mass of reviews, confining these to a smallish number of the most important books. He was never deterred from a problem by the necessity of learning a fresh language, not sharing the fear so common among younger American scholars of an unfamiliar tongue. Even his publications are no sufficient index to his attainments and grasp. It is reported that, at a private dinner of a dozen academics, by a lady's request

he held them spellbound for an hour by a simple and lucid outline of the whole history of the European drama. During the first World War as captain and major in the War College in Washington he did original and notable work on codes and ciphers, as to which he had in private ludicrous tales to tell.

He had his eye and interest awake for important matters of educational policy and organization, and was in demand for such affairs in his own university; not matters of routine, but what affected momentum and distinction throughout the humanities. His prolonged and frequent visits to England made him almost as well-known and quite as highly esteemed there as here, and brought him such tributes as the presidency of the Modern Humanities Research Association in 1922. One of his special contributions was in the Modern Language Association of America, of which he was President in 1921. This, which had reached a membership of thousands, was still conducted as if only of hundreds; through his influence it recognized the wide variety of interests among the whole and the special concentrations of interests among individuals. Thus the stimulus of its meetings was greatly increased, and also the chance for many members to be heard and to employ their executive abilities.

To many the greatest thing about Manly was his personality. Besides the constant intellectual activity and ingenuity already indicated, his steady zeal for scholarship gave him pretty much the same appreciation for others' work and problems as for his own. Hardly any man kept so close on the track of contemporary learning and of promising younger scholars. Such vital interest made him a charitable judge, and proceeded also from his real modesty and freedom from egotism. Few English scholars have brought up more young men and women who have remained intellectually fertile, and their devotion to him one infers is due mainly to his stimulating and encouraging attitude. It is related that one of them entered the office of the English department at Chicago exclaiming, "The three greatest men that God Almighty ever made are Adam, a still more august personage, and John Matthews Manly." His generosity to *Fachgenossen* in other institutions, even some not close friends, knew no limit. No hoarding of his own ideas or collectanea or documents; all his tools were free to him who knew how to use them. His courage in meeting the problems of life knew no more limits than did his generosity. All this

with his chuckling laugh and his epigrammatic humor made him the most attractive and genial of companions.

J. S. P. TATLOCK.

RAYMOND PEARL

(1879–1940)

There are two kinds of men of science whose interests and activities greatly contrast. One kind, the orthodox, today very numerous, proceed by a kind of orthogenetical development and do not often step aside from a straight and narrow path. The other kind, rare today though often met with three or even two centuries ago, feel that their intense interest in all things—their *philosophical* interest, in an older sense of the word philosophical that has been preserved in the name of our Society—is a safe guide. Such a man was Francis Galton and another, in some measure a disciple of Galton's, was Raymond Pearl, who was elected to membership in the American Philosophical Society in 1915.

He was born on the third of June, 1879, in Farmington, New Hampshire, the descendant of long lines of New England ancestors. He graduated from Dartmouth College in 1899. For Pearl these were important influences. Throughout his life he felt himself a north of Boston man and cultivated and cherished the sentiments and some of the prejudices of his people and of his region. Perhaps, being the man he was, he could not help doing this, but for the same reason he knew what he was doing and did it with a pleasant feeling for the human comedy; as a human biologist he knew the value of sentiments and prejudices.

In 1902 Pearl became a Doctor of Philosophy in Biology of the University of Michigan, where for four years he was Instructor in Zoology. He studied in Europe at Leipzig, at the Naples Zoological Station, and especially in the Galton Laboratory of University College, London, with Karl Pearson. On his return to this country Pearl was for one year Instructor in Zoology at the University of Pennsylvania and then became Head of the Department of Biology of the Maine Agricultural Experiment Station. During the World War he was Chief of the Statistical Division of the United States Food Administration, and in 1918 he became Professor of Biometry and Vital Statistics in the newly established School of Hygiene and Public Health of the Johns Hopkins University. From 1925 to

1930 he was Director of the Institute of Biological Research in that School. From 1919 to 1935 he was statistician to the Johns Hopkins Hospital, from 1923 until his death Professor of Biology in the Johns Hopkins Medical School, and from 1930 in the School of Hygiene and Public Health.

Pearl was the founder and editor of two scientific journals, the *Quarterly Review of Biology* and *Human Biology*. In both these enterprises he enjoyed the able assistance of Mrs. Pearl. He was one of those most concerned with the foundation of the International Union for the Scientific Investigation of Population Problems and was the first president of the Union.

Pearl's researches, so numerous and varied, are not easy to describe. As early as 1901 his bent for quantitative biology was manifested by a study of variation in fishes and a little later it was probably this bent that led him to the Galton Laboratory. In Maine he worked on diseases, genetics and problems of population in domestic animals, especially poultry. At Johns Hopkins he studied problems of inheritance, of environment including social environment, of length of life, of reproduction and sex, of growth and of population. In his own mind these researches probably all bore upon human biology, though for experimental work he employed many different species of animals and even of plants. Almost all his work was quantitative; it was biometrical or statistical or both. It made use not only of his own experimental results but also of field studies prosecuted under his direction, of hospital records and of all sorts of vital statistics.

The results of these studies—a varied, great and enduring achievement—are embodied in many papers and in his books: "Poultry Diseases and Their Treatment" (with F. M. Surface and M. R. Curtis, 1911); "Diseases of Poultry" (1915); "The Biology of Death" (1922); "Studies in Human Biology" (1924); "The Biology of Population Growth" (1925); "Alcohol and Longevity" (1926); "The Rate of Living" (1928); "Constitution and Health" (1933); "The Ancestry of the Long-Lived" (with Ruth D. Pearl, 1934); "The Natural History of Population" (1939). He also published "Introduction to Medical Biometry and Statistics" (third edition, 1940), a textbook, and "To Begin With" (1927), a guide to intelligent wide reading for young biologists, which is imbued with his own feeling of eager interest in all human experience and its expression.

In his professional life and work Pearl was chiefly a Human Biologist. He liked the term, gave it to one of his Journals, applied it to himself, and I think did more than any other man to fix the ideas, or at least many of the ideas hitherto neglected by anthropologists and sociologists, that seem indispensable for the growth of the science which he foresaw. He was a biologist in the sense, especially, that he was interested in what happens to "the organism as a whole." He was interested in the individual and not directly in what can be abstracted from it, as hormones and nerve impulses can be abstracted. He was interested in the relations of the individual to the environment—to the physicochemical environment, to other individuals and to the social environment.

Pearl was a man of immense vigor. He was laborious, full of initiative, full of ideas and projects, and curious of all things. He enjoyed with gusto work and play, thought and art, literary composition of which he was a master, men and women and all living things. A seemingly trivial expression of his scorn for a certain psychologist who studied dogs, never having had a dog of his own, arises from this enjoyment as well as from his profound conviction that you must thoroughly know the living things you study. These qualities and a powerful intellect contributed to the work of a life that has broadly influenced biology and deeply influenced his pupils, his associates and his friends.

Raymond Pearl died November 17, 1940. In 1903 he had married Maud M. DeWitt of Sandusky, Ohio. Mrs. Pearl and two daughters survive.

L. J. Henderson.

CHARLES LEE REESE [1]

(1862–1940)

Dr. Charles Lee Reese, a former president of the American Chemical Society and a member of the board of directors of E. I. du Pont de Nemours & Company, died on April 12 at Jacksonville, Fla., following a heart attack. Dr. Reese would have been seventy-eight years old November 4. He and Mrs. Reese had left their home in Wilmington, Del., to spend the winter in Florida.

[1] Reprinted from the *Journal of the American Chemical Society* 62: 1889 (1940).

At his retirement January 1, 1931, Dr. Reese completed a distinguished career as an educator and industrial leader. Between 1911 and 1924 he was Chemical Director of the du Pont Company, thereafter serving as a consultant until his retirement.

Dr. Reese was a native of Baltimore, where he was born in 1862, a son of the late John S. and Arnoldina O. (Focke) Reese. After attending Johns Hopkins University for one year, he transferred to the University of Virginia. Upon completing his studies there in 1884, he went to Germany to study chemistry at the Universities of Heidelberg and Göttingen, receiving the degree of doctor of philosophy from Heidelberg in 1886. Studying under Bunsen, then in his prime, he completed the work for the degree in the remarkably short time of eighteen months.

Upon his return to the United States, he became an assistant in chemistry at Johns Hopkins University and remained a member of that faculty until 1888, when he joined the faculty of Wake Forest College for one year before going to South Carolina Military College at Charleston as Instructor in chemistry and physics.

In 1896 he returned to Johns Hopkins as an instructor and served in that capacity until 1900, the year in which he decided to leave teaching and enter the industrial field. His first industrial post was as chief chemist for the New Jersey Zinc Company, where he was largely concerned with problems incident to the manufacture of sulfuric acid. He joined the du Pont Company in 1902.

Dr. Reese's professional achievements centered in his rôle as one of the pioneers in the development of modern commercial blasting explosives, especially the so-called permissibles for use in gaseous and dusty coal mines, gelatin dynamite, and non-freezing dynamite. He carried out some research work before entering the industrial field on the origin of the Carolina phosphates and as a result of his investigations contention among geologists over the origin of these phosphates was ended. Later, in conjunction with Professor H. N. Morse of Johns Hopkins University, he published important papers on the oxides of manganese.

It was his successful adaptation of the contact process for the manufacture of sulfuric acid that first brought Dr. Reese to the attention of the du Pont Company. As a result of this work, the Company employed him to take charge of their acid manufacturing operations and his chemical training and ability quickly led

to an extension of his responsibilities to the study and improvement of the formula of commercial dynamites.

Upon his engagement in 1902, he established the Eastern Laboratory of the du Pont Company, one of the pioneering industrial research organizations, becoming the Director of this Laboratory. In 1911 the organization of the Chemical Department of the du Pont Company occurred with Dr. Reese at its head. Ably assisted by such men as Dr. Wm. Weedon and Dr. Wm. M. Whitten and other men of outstanding ability, a policy was initiated and consistently followed of employing young graduate chemists and building up a research organization. This staff, composed largely of young, well trained research personnel, proved of surpassing value during the following years. At one time, during the World War, the force of chemists employed by the du Pont Company numbered twelve hundred.

Dr. Reese was elected a Director of the du Pont Company on October 31, 1917. In the following year he was made a Director of du Pont American Industries, Inc. Dr. Reese served as President of the American Chemical Society in 1934, having been made chairman of the Society's board of directors in 1930.

Among other offices which he held were president of the Manufacturing Chemists' Association, vice-president of the International Union of Pure and Applied Chemistry, president of the American Institute of Chemical Engineers, associate member of the Naval Consulting Board, member of the visiting committee of the Bureau of Standards, and president of the Lalor Foundation. In the National Research Council, he was vice-chairman of the division of chemistry and chemical technology and vice-chairman of the research information service.

He served on the advisory boards of the Chemical Welfare Service and the Alcohol Trades Advisory Commission. He was a member of the Deutsche Chemische Gesellschaft, the Institution of Chemical Engineers of Great Britain, the Royal Society of Arts, the American Association for the Advancement of Science, the Franklin Institute, and the American Philosophical Society.

The University of Heidelberg awarded him the honorary degree of doctor of science in 1936 on the fiftieth anniversary of his first doctorate degree. He had received the honorary degree of Sc.D. from the University of Pennsylvania, the University of Delaware, Colgate University, and Wake Forest College. The University of

Virginia chapter of Phi Beta Kappa made him an honorary member in 1920.

His clubs included the Chemists' Club of New York, the Wilmington Country Club, and the Church Club of Delaware. Dr. Reese's non-professional interests were broad, embracing music and the arts. He had served the Wilmington Society of Fine Arts as president.

Surviving are his wife, the former Harriet Stedman Bent; four sons, Charles Lee Reese, Jr., of Greenville, Del.; D. Meredith, of Washburn, Wis.; John S., of Wilmington, Del.; and Eben Bent, of Seaford, Del.; also a sister, Miss Virginia Reese, of Baltimore.

The Board of Directors of the du Pont Company on April 15 adopted a resolution expressing profound sorrow at the death of Dr. Reese and recapitulating his record of achievement.

ROBERT E. CURTIN, JR.

FLOYD KARCHER RICHTMYER

(1881–1939)

Floyd Karcher Richtmyer was born October 12, 1881 near Cobleskill, New York. After attending local public schools he entered Cornell University and graduated in 1904, having specialized in Physics. After two years as Instructor in Physics at Drexel Institute in Philadelphia, he joined the Physics Department of Cornell University where he was successively raised to the positions of Assistant Professor and Professor of Physics. He became Dean of the Graduate School in 1931, a post he held until his death. As part of his teaching career he served as visiting lecturer in physics at Columbia, Stanford and the University of California.

This brief summary of Richtmyer's teaching activities gives a very imperfect idea of his varied contributions to physics and his activities as a research worker and administrator. In the latter field he was an outstanding figure, as is evidenced by the fact that he was chosen as President for three of the national societies devoted to the advancement of physics, the American Physical Society, The Optical Society, the American Association of Physics Teachers as well as holding the Vice-presidency of Section B of the A. A. A. S. He served on numerous committees where his wide experience, enthusiasm and extraordinary industry made him an im-

portant figure in the coordination and advancement of physical science in this country.

As an investigator his work falls under two headings. His earlier work was in the problems of photometry and illumination. In this work he was one of the pioneers in the now general use of photoelectric cells in photometry. The second period of his research work was devoted to intensive work in X-ray spectra. For this work he established one of the chief X-ray laboratories in the country at Cornell from which a series of papers by Richtmyer and his associates established the fundamental phenomena connected with X-ray absorption and the fine structure of X-ray lines.

While carrying on his work as teacher and investigator Richtmyer also devoted a great deal of time and profitable effort as an editor of scientific journals and of a series of scientific text books, "The International Series in Physics" published by the McGraw-Hill Book Company, to which he contributed his own popular "Introduction to Modern Physics." His editorial work included the business managership of the combined *Journal of the Optical Society* and the *Review of Scientific Instruments,* and later for a number of years, until his death, the *Journal of the Optical Society of America.* He served as well on the editorial boards of several other journals, and on the board of the American Institute of Physics under which all the principal journals in Physics are now published.

During the last ten years of his life the calls upon Richtmyer for administrative and committee work demanded most of his time, and in it he became a unique figure because of his contact with and participation in all the bodies devoted to the advancement of physics. In this capacity he was repeatedly in demand for important positions, and almost invariably undertook to carry the additional work demanded. These posts included the chairmanship of the Division of Physical Sciences of the National Research Council, 1930–35, and the life trusteeship of the National Geographical Society. He was elected to the National Academy of Sciences in 1932, serving as a councillor at the time of his death; to the American Philosophical Society in 1935 and to the American Academy of Arts and Sciences in 1935. He received the honorary degree of Doctor of Science from Lehigh University.

Richtmyer's personality was most attractive. He counted a host of friends among his scientific colleagues, and among the many younger men whom he wholeheartedly counseled, encouraged and

aided. His appearance was always very much that of a country lad, a rather gangling figure, loosely dressed, with an honest and rugged face. As a conversationalist he was seriously attentive to the matter in hand, but was blessed with a strong sense of humor. He always appeared master of his problems, undiscouraged and untiring, but frank and honest.

Surviving him are his wife, Bernice Davis Richtmyer, and three children, Robert D., Sarah (Mrs. Mann), and Lawson D.

HERBERT E. IVES.

ALBERT SAUVEUR

(1863–1939)

Albert Sauveur was born in Louvain, Belgium, on June 21, 1863. His father was a teacher of languages and writer of textbooks. Following schooling in Brussels and then five years (1881–6) in the Liege School of Mines, he came to the United States in 1886 and entered the Massachusetts Institute of Technology. With emphasis on his interest in mining and metallurgy, he graduated with the S.B. degree in 1889 and found employment in what he later denominated as "that preserve closet of steel works known as the chemical laboratory."

"Life in a steel mill chemical laboratory," said he in some witty reminiscences published in 1937, "lacks enchantment. I entered it every morning at seven o'clock to leave it at six o'clock. To be sure, on Saturdays we stopped our labor at 5 p.m.; but as we had only fifty minutes for refreshment at noon, you will see that we worked, if that is the correct way to express it, exactly sixty hours per week.

"While I had been told that I would be paid $50 per month for my services, when my first pay check arrived I found to my disappointment and indignation that it was only for $40. Lest you infer that a college education was worth very little in those days, you should recall that unskilled labor was being paid $1.00 for ten hours' work whereas I received $1.67; from which it follows that a college education was worth sixty-seven cents."

The conditions of these mills at Steelton did not provide attractions for an ambitious young man of creative mind. With much spare time, he read and made notes on the then existing books relating to ferrous metallurgy. This was helpful, but not adequate

to his ambitions, and in less than two years he was at South Chicago in the works of the Illinois Steel Co. There, after some months, he was furnished a microscope and authorized to study the structure of steel microscopically.

Sorby in England, Osmond in France and Martens in Germany had already opened the field of study in micrometallurgy; but this was the beginning in America of work in this important application of science.

"I was given a room all to myself," says Sauveur in his reminiscences, "supplied with an old-time microscope and instructed to study the structure of steel and the ailments to which its flesh is heir. I may perhaps be permitted to say, without being accused of an utter lack of modesty, that this small beginning marked the introduction of metallography in the iron and steel industry of the United States."

During five happy years he was thus employed, with valuable service to his company. Two notable papers, "The Microstructure of Steel" and "The Microstructure of Steel and the Current Theories of Hardening," were published in this country in this period and lent a wider reputation to his work; but his work was so far ahead of the steel-making art that it was received coldly in steel-mill circles, with perhaps more of sneers than of appreciation.

"When some metallurgical wag," says he, "discovered that by photographing a certain variety of ginger snap under the microscope a design was obtained suggesting the structure of mild steel, it was a source of much gratification in some quarters and it was predicted that a deathblow had been dealt to the microscopical examination of steel."

Now a change of management in the Illinois Steel Company submerged the careful studies for improvement of quality by an obsession for tonnage of production; and scientific metallurgy was swept away in the South Chicago mills.

Nor did Sauveur find hospitality for his work among other steel companies or among users of large quantities of steel. President Harper of the University of Chicago and President Drown of Lehigh University found no corner in their institutions for his work. In the meantime, he had married the young woman who became the gracious companion and inspirer of his farther life.

The courage of a creative-minded man does not break down, and "ginger snap or no ginger snap," says Sauveur in his rem-

iniscences, "he [the young metallurgist] was not to be defeated. He would become a free lance. He opened some testing laboratories in Boston, and in 1898 a quarterly publication known as the *Metallographist* made its appearance; a daring undertaking, as I look at it now [1937] in my more matured age, for a young man to attempt single-handed. So many kind words have been spoken, however, about the part played by this publication in creating an interest in metallography that I am glad now that I did not have, at the time, the wisdom and prudence to keep me from an undertaking in appearance so hazardous." This journal, in its early days a voice crying in the wilderness, continued seven years under its original and a succeeding name, and ultimately was absorbed by the long-established *Engineering and Mining Journal*.

In 1899, Sauveur was established as Instructor in Metallurgy in Harvard University. His promotion in the University and his growth in reputation were equally rapid. In 1905, he was made Professor of Metallurgy and continued active in the Harvard faculty until retirement as Emeritus Professor in 1935. During this time he was unremittingly directing research and writing within his field, as well as serving as technical adviser to industries.

Whatever losses individual steel-producing companies suffered from failure to promptly recognize the significance of Sauveur's early work, when he was in their employ, there is no question about the value to the metallurgical industries in general which flowed from the work carried on in his laboratory at Harvard and from his advisory services in various directions. His influential book entitled, "The Metallurgy and Heat Treatment of Iron and Steel" was first published in 1912 and his other publications during the period of his life number some 150—mostly lectures and articles.

His life was full of the joyous excitement of an engineer who finally sees the art profiting from science, which he had done so much to establish in this country. "What days," he remarks, "we did live during the last decade of the last century and the first decade of the present! What harvest was being gathered!"

As he appreciated the interest in his life, he also was appreciated and received many honors. He was a member of the National Academy of Sciences, the American Philosophical Society (elected in 1919), a Fellow of the American Academy of Arts and Sciences, Honorary Member of American Institute of Mining and Metallurgical Engineers, American Society for Metals, Societé des Ingénieurs

Civils (France), Societé de l'Industrie Nationale (France); besides being a member of various other societies at home and abroad. He was Officer of the Académie (France), Officer of the Legion of Honor (France), Officer of the Order of Leopold (Belgium), and recipient of medals conferred at home and abroad: including the Elliott Cresson Medal of the Franklin Institute, the first Albert Sauveur Achievement Medal of the American Society for Metals, the Bessemer Medal of the Iron and Steel Institute (Great Britain), the Trasenster Medal of the Association of Graduate Engineers of the University of Liège, and the Franklin Medal of the Franklin Institute (posthumously).

Among his professional engagements were: Metallurgist for the American Aviation Commission in France 1917–19 and metallurgical expert for the French Ministry of Munitions during the same period.

Honorary Doctorates were conferred on him by universities here and abroad.

Held, though he was, by an expanding thread of science which was deeply affecting the steel-making art, his home life was nevertheless a primary and tender interest. On his death on January 26, 1939, he left a widow and two married daughters, with whom the associations had been of the greatest charm. A son had died at a tender age. His connection with Harvard University as a Professor was to him a delight. The association with staff and students fascinated him, for he was born with the teacher's spirit. Among his papers was a brief abstract from the "Autobiography of William Lyon Phelps": "I had rather earn my living by teaching than in any other way. In my mind, teaching is not merely a life work, a profession, an occupation, a struggle; it is a passion. . . . I love to teach as a painter loves to paint, as a musician loves to play, as a singer loves to sing, as a strong man rejoices to run a race. . . . So far from being dull routine, teaching is to me the most adventurous, the most exciting, the most thrilling of professions. . . . The excitement of teaching comes from the fact that one is teaching a subject one loves to individuals who are worth more than all the money in the world."

Sauveur's attitude toward this sentiment respecting teaching was deeply felt by his students and colleagues. The influence is expressed in a brief memorial drawn up by the technical staff of

one of our smaller steel companies, with the work of which Sauveur was intimate:

"We have lost Albert Sauveur, . . . esteemed and beloved 'Dean of American Metallurgists' and pioneer of metallography. . . . Our successors cannot know the man, Albert Sauveur, but those who knew him intimately will never lose the subconscious influence which he had over them."

Such was his evaluation by his students and technical colleagues. The honors conferred upon him show his evaluation by the world.

Dugald C. Jackson.

FRANK WILLIAM TAUSSIG

(1859–1940)

Frank William Taussig was born in St. Louis, December 28, 1859, the son of William and Adele (Wuerpel) Taussig, and died at Cambridge, Massachusetts, November 11, 1940. He was graduated at Harvard University, in 1879, with academic honors. After a year at the University of Berlin studying economics, he returned to Harvard and served for two years as secretary to President Charles W. Eliot, and continued his studies in economics and the law, securing the degree of Ph.D. in 1883 and that of LL.B. in 1886. From 1882 to 1886 he was also Instructor in Economics. From 1886 to 1892 he held the rank of Assistant Professor at Harvard, and became Professor of Political Economy in 1892, which position he held until his retirement in 1935. During more than a half century he was continually engaged (except for brief absences in the public service) in teaching and writing in the field of economics and as editor of the *Quarterly Journal of Economics*, now the oldest economic journal published in the English language. In these ways he exercised an influence over a greater number of students of economics who later became in their turn college teachers than, perhaps, any other teacher of his time. He was the recipient of numerous honors, including honorary degrees from Brown, Northwestern, Michigan, Bonn, and Cambridge Universities. He was President of the American Economic Association in the years 1904 and 1905; Chairman of the Tariff Commission in President Wilson's administration; and served on various other commissions for the public betterment. He was elected to membership in the American Philosophical Society in 1929.

His large list of writings covers a wide range of subjects in the broad field of economics. Best known are: "The Tariff History of the United States," the first portion published in 1888 and extended with the successive changes in the tariff; "Wages and Capital," a critical study of earlier theories, 1896; and "Principles of Economics," 1911, used extensively as a text book and repeatedly revised. Professor Taussig's teaching, writings, and public service in relation to tariff theory and policy form the main foundation for his wide academic and popular reputation.

In respect to fundamental concepts and systematic theory Professor Taussig remained, among American economists, the most "orthodox" in the English Ricardian tradition. His treatment centered around the material factors of production and a cost analysis of price economics. He appeared to accept "in principle" the newer psychological analysis, but he frequently depreciated it, and did not go as far in revising the older views as did even the English economist Alfred Marshall, to whom he has frequently been likened. As has been said by one of his own pupils and colleagues, "he adhered much more strictly to the classical system." However, beginning with his address on "The Love of Wealth and the Public Service" (1906) he gave increasing importance to human nature as a factor in the explanation of economic phenomena. His lectures on "Inventors and Money Makers" appeared in 1915, and a notable essay on "American Business Leaders" in 1932; and meantime many of his papers and addresses dealt with the human aspects of economic problems.

Professor Taussig's treatment of contemporary issues was always marked by an eminent practicality, verging on a policy of compromise, better characterized, however, as a fine sense of the golden mean. His firm belief in the system of private property and free enterprise as justified by experience, never made him an apologist for numerous defects in the present order of society. He was never a defender of special privilege. He was essentially an economic liberal, an advocate of progressive amelioration of the condition of the masses in a democracy; but he saw clearly the shallowness and eventual disaster in many of the popular remedies, and he courageously rejected them. His manner both in speaking and in writing manifested a dignified, benignant, and judicial character. He was an incorruptible scholar, unswerving in his loyalty to the public good.

FRANK A. FETTER.

SIR JOSEPH JOHN THOMSON

(1856–1940)

Sir Joseph John Thomson, who was elected to membership in the American Philosophical Society April 3, 1903, was unquestionably the most conspicuous and the most influential figure in the development of the electron theory. He was born at Manchester, December 18, 1856, was educated at Owens College, Manchester, up to 1876, and at Trinity College, Cambridge, where in 1880 he graduated as second wrangler. In 1881, when he was twenty-four years old, he wrote what has become a classic paper on the mass of an electric charge of radius "a" $\left(m=\frac{2}{3}\frac{e^2}{a}\right)$. He was elected Cavendish Professor of Physics in 1884 at the early age of twenty-eight, and in 1892 published his first notable book entitled "Recent Researches in Electricity and Magnetism." In this he made the first systematic and quite complete presentation of the work that had appeared up to that date on the conduction of electricity through gases, particularly in well exhausted tubes. Plücker had been the experimental pioneer in this field in Germany, his first paper, in which he noted fluorescence and magnetic deflection, appearing in 1860. His pupil, Hittorf, in 1869 noted straight line propagation as evidenced by the shadows cast. Varley in England in 1871 first interpreted the phenomena as due to negatively charged "attenuated particles." Goldstein introduced the term "cathode rays" in 1876. Sir Wm. Crookes, between 1876 and 1880, made more elaborate experiments and wrote: "The phenomena in these exhausted tubes reveal to physical science a new world—a world where matter exists in a fourth state. . . . In studying this fourth state of matter we seem at length to have within our grasp and obedient to our control the little indivisible particles which with good warrant are supposed to constitute the physical basis of the universe."

By the middle nineties the so-called English school was a unit in interpreting cathode ray phenomena in terms of charged particles of some sort, projected from the cathode. The German school, on the other hand, in view of the experiments of both Hertz in 1892 and Lenard in 1894 in showing that the cathode rays could pass through thin metal foils was united in the view that cathode rays were not particle-rays at all, but instead represented an aether

phenomenon of the general nature of light. It was J. J. Thomson's famous paper in the *Philosophical Magazine* of 1897 that not only definitely convinced the world of the correctness of the view of the English school, but also marshalled the evidence of a considerable variety of new experiments to prove that the "corpuscles" which constituted the cathode rays were constituents of every kind of atom and that, on the assumption that their charge was constant and the same as G. Johnstone Stoney's "Electron," the name advanced by him in 1874 for the ultimate unit of electrical charge, their mass was about a thousandth that of the smallest existing atom, namely, that of hydrogen. Kaufman's measurement of e/m made at nearly the same time as Thomson's measurements on the same quantity were in fact more accurate than were Thomson's, but it was the evidence that Thomson adduced that this same elementary particle was a constituent of every type of atom that was needed to convince the world of the truth of the electron theory, so that the chief credit for this stupendous advance in our understanding of the nature of matter properly belongs to him, and to him alone. That this is one of the major discoveries in world history needs no argument.

Even without this, however, Thomson's claim to an important place in the world's hall of fame is altogether secure, for he was the inspirer, the leader, the creator of perhaps the most productive school of scientists that has ever existed anywhere, a school which not only played the leading role in the whole development of the electron theory in all its phases, but which took the tangled mass of radioactive phenomena and evolved from it a beautifully ordered system of interpretation leaving it a reasonably completed and lasting structure which has since served as a firm foundation upon which other advances of the greatest significance for man's understanding of the universe have been built. In his Silliman lectures in Yale published in 1903 Thomson was the first to advance the view that X-rays and gamma rays travel through space, not as spreading waves, but as discrete bunches of energy. This is now the basic assumption of the quantum theory of radiation which Einstein first adopted in 1905, but which Planck had been unwilling to accept as late as 1912.

Thomson was remarkable in that he retained up to the very time of his death at the age of 83 his devotion to his own personal experimental researches. Only three years ago I was searching

through the Cavendish Laboratory to find Aston and ran upon Thomson alone in his room dressed in his laboratory gown, peering through his microscope and measuring up some photographs he had just taken. He was a man whom it was a rare privilege to have known personally. His passing removes from our midst one of the great figures of modern physics.

ROBERT A. MILLIKAN.

SAMUEL MATTHEWS VAUCLAIN

(1856–1940)

When Samuel Matthews Vauclain died at his home in Rosemont, Pennsylvania on February 4, 1940, there passed one of the truly great men of our time; one of the world's most distinguished citizens. The railroad world which loved and honored him and which he had loved and served so well, lost a man who had devoted his energy and genius to it for more than 65 years.

He was born May 20, 1856, at Port Richmond (Philadelphia), Pa., the son of Andrew C. and Mary Campbell Vauclain. Shortly thereafter, his father accepted a position with the Pennsylvania Railroad and the family moved to the newly established town of Altoona. Although educated only at the public schools there, he later received the honorary degrees of D.Sc. from the University of Pennsylvania and from Worcester Polytechnic Institute, and L.L.D. from Villanova College.

At the age of 16 he entered the Altoona Shops as a special apprentice. So efficient did he prove in every job he undertook that he was appointed an Assistant Foreman at the age of 21. In 1883 he was sent to Philadelphia to supervise the construction of sixty locomotives then being built for the Pennsylvania Railroad by The Baldwin Locomotive Works. Here he showed such ability and capacity that he was offered a permanent position by the Baldwin firm and on July 1, 1883, entered their employ as Superintendent of the 17th Street Shops. On February 11, 1886, he was appointed General Superintendent of the entire plant and on January 1, 1896, he was elected a member of the firm of Burnham, Williams & Company. With the incorporation of the concern on July 1, 1909, he was appointed General Superintendent. On July 1, 1911, he was appointed Vice President, on September 6, 1917, Senior Vice Presi-

dent, on May 19, 1919, President and on March 28, 1929, Chairman of the Board, which position he held until his death.

He, more than any other one man, was responsible for the expansion of The Baldwin Locomotive Works to its present size and capacity. A foremost authority on steam and its application to railroad transportation, his own contributions through inventions and development to the design and construction of the steam locomotive, gained recognition throughout the world. During the World War, his energy and ability were largely responsible for furnishing the United States and the Allied Governments with large amounts of ammunition, rifles and locomotives in record breaking time. As a member of the Delaware River Bridge Joint Commission, this same energy and ability played a prominent part in bringing the construction of the bridge to a successful conclusion.

From his early boyhood, when he invented a simple device for shelling corn expeditiously and without damage to his hands, he consistently approached any task assigned to him "with a determination to shorten time, improve quality and reduce cost." The following extract from an illuminating and inspiring address entitled "Mass Production within One Lifetime," which he delivered before the American branch of the Newcomen Society of England at a luncheon given in his honor at the Rittenhouse Club, Philadelphia, on October 5, 1937, is indicative of an outstanding characteristic of going after his objective in a direct fashion and of his ability as a leader of men. "I had the vision as to how mass production in every branch of our industry could be accomplished and I had built up a fine body of engineers, superintendents, foremen and workmen, to all of whom I sold my ideas and they were so inspired that with mass production ever in their minds, mountains of impossibilities were overcome." This address, published by the Society in 1937, as well as his autobiography entitled "Steaming Up," published in 1930 and dedicated to his former shop-mates, exemplify his simplicity of character, his great humaneness and his real sense of humor.

His business acumen and sagacity naturally resulted in his election as a director of many important industrial companies and financial institutions. His broad outlook and versatility of interests are well reflected in the number of organizations of which he was a member, such as local and foreign Chambers of Commerce, Engineering Associations, Scientific and Educational Institutions,

Academies and Associations. He was elected a member of the American Philosophical Society on May 19, 1889; was a Councillor of the Society from 1917 to 1919 and later became a member of the Wistar Association. He was a manager of several hospitals and a member of outstanding athletic, social and professional clubs in Philadelphia and elsewhere.

The esteem in which he was held both in this country and abroad is partly evidenced by his having received the Distinguished Service medal in 1919 from the Government of the United States and important decorations from the Governments of Italy, France and Poland. Also, The Franklin Institute, with which he was closely associated for years as a member of its Board of Managers, conferred upon him the Elliott Cresson Gold Medal in 1891 for his Combined Locomotive.

The following extract from a statement prepared by some of his business associates soon after his death is well worth quoting—"To think of Mr. Vauclain is to think of those who shared his labors, for he was essentially a worker. He was proud of the fact that he had started his career as an humble apprentice; proud even when he headed the Baldwin organization, to join his men in the shops and put his shoulder to the wheel. Mr. Vauclain often remarked that the man who liked his job and who 'worked for work's sake,' not only found contentment but material success as well. With him this was not merely a theory, it was the rule by which he regulated his entire business life. In his success it found its highest fulfillment. This man, whose great character we attempt to so feebly portray, was a devoted husband, father and grandfather, philanthropist, world traveler, business executive, salesman, mechanic, and public-spirited citizen. He was an optimist in the best sense of the word. Not only did he believe in the future of his country and his fellow-man, but he devoted his best energies to the task of making his dream come true."

SAMUEL P. WETHERILL.

VITO VOLTERRA

(1860–1940)

It seems that in the minds of contemporary mathematicians, whatever their specialty may be, the name of Vito Volterra is usually associated with the creation of the theory of functionals ("func-

tions of lines'' is their earlier designation) and with the theory of integral and integro-differential equations. These entities are, as a matter of fact, of immense scope, and without doubt constitute the profound basis of almost all the research work of the great geometer; and yet his studies on permutability and composition, strictly related to the theory of functionals, those on the Cauchy problem in linear partial differential equations, those on biomathematics could, each of them separately, glorify more than one mathematician.

The theory of functionals, one of the very first inspirations of this Italian scholar, has admitted of such wide extension during the last thirty or forty years, and its applications in theoretical physics are now so important and so numerous, that we may say, without exaggeration, that it constitutes, together with point set theory and the theory of groups, the basis of modern mathematical knowledge. And this is true both in pure mathematics and in the applications of mathematics to physics and astronomy. One of the best modern mathematical reviews, *Studia Mathematica,* is particularly devoted to this subject.

In Volterra's mind, functionals were born simultaneously with the idea of passing from the finite to the infinite from the dimensional point of view, and we can easily imagine that the most surprising concept for his earlier readers was that of a function considered as a point embedded in a space of a non-denumerable number of dimensions, the indices being the arguments of the function running over the entire interval, and the coordinates being represented by the values of the function. And if today such an idea seems very natural it is because our mentality has been constantly formed by all the concepts flowing from Volterra's early work. The idea of a functional which consists in attaching, in a manner analogous to that used with a function in ordinary space, a number to a function-point occurs in modern mathematics in almost all the stages of mathematical creation.

This same idea of infinitely dimensioned spaces has constituted the basis of Volterra's discussion of his integral equations. Such equations, in the light of this new concept, appeared as a generalization of a system of linear algebraic equations and properties of their solutions were then easily forecast. Many authors have been, up to this day, largely inspired by those ideas, even if some of them seem not to have been fully aware of the obligation. Certain well-

known spaces used in modern topology may be considered as directly arising from Volterra's investigations in the theory of integral equations.

Introducing functional derivatives, Volterra was able to include in a single set of questions many problems, some of which are related to the Dirichlet problem, and, in a general way, to what are now called the "limit problems" in the theory of partial differential equations. Known and new quantities involved in the calculus of variations appeared suddenly as "differentials." May we say, moreover, that these concepts have thrown light on the profound axioms of the differentials. Many modern authors have been able to gain their own justified fame by adapting Volterra's ideas in order to introduce the notion of abstract differentials.

The harmonious peak of his considerations on functionals, their derivatives, and integral equations is reached, not only from the theoretical point of view, but also from the point of view of applications to quantum electrodynamics, quantum mechanics, and other such subjects, in Volterra's theory of integro-differential equations.

Unusually aesthetic is this Italian geometer's theory of isogenic functions. To every closed curve in the three-dimensional space corresponds a set of two complex numbers. And the mere existence of a derivative of one of these numbers, with respect to the other, furnishes a kind of analyticity, very rich in properties and applications. This concept does not constitute a simple analogy to Cauchy's theory of complex functions. These isogenic functions can be considered as giving an analytic prolongation of the Cauchy-Beltrami functions on a surface. And once more modern topology has been able to use Volterra's ideas for one of its important branches, the theory of connectivity.

One of Volterra's new principles is that of "algebraization"—if we may use this term—of mathematical analysis. Permutability and composition appear through the introduction of a compositional algorithm as new fields of algebra, and may be considered as the predecessors of the modern abstract algebras, including that of matrices.

Volterra's research work which is masterfully presented in his Stockholm lectures must be regarded as the beginning of the profound new theory of partial differential equations, particularly of the hyperbolic type. It is remarkable that this mathematician,

whose approach was almost always from the physicist's point of view, and who always thought of the applications of his work to the different fields of the exterior world, introduced as a fundamental "elementary solution" of hyperbolic equations a solution which was the least forecast by physical considerations. But the point is that the generalization of just this solution has made possible the latest progress in this theory.

It is difficult to give even a slight idea of all of Volterra's work. His investigations are great in too many fields! We have not alluded to his work on linear differential equations, on elasticity, and other problems in physics and astronomy. We must add, however, a word concerning his last work on the mathematical theory of the struggle for survival. Ordinarily the individuals of a biological society contend for the same food, but, says Volterra, they may sometimes help each other. His theory based on the properties of the integrals of some differential and integro-differential equations, allows a study of the variations arising from the struggle in such a society.

Volterra was not only a very great inventor, but also a great mathematical writer and a great teacher. Those who had the opportunity of attending his lectures, as did many American scholars on the occasion of his several visits to this country, will never forget his radiant face; as he lectured he was constantly near to infinity which he understood so well.

He was a member of almost all the important academies and scientific societies in Europe and America, and had been a foreign member of the American Philosophical Society since 1914. Professor at the University of Rome, he was for many years President of the Accademia dei Lincei, and an Italian Senator. He was also President of the International Committee on Weights and Measures. His books were written in, or translated into, many languages. Many modern mathematicians in America and in Europe regard it as an honor to have been his students.

S. Mandelbrojt.

HANS ZINSSER

(1878–1940)

The bacteriologist Hans Zinsser was born in New York City on November 17, 1878. There he died on September 4, 1940, having

lived one of the most complete and deeply experienced lives of his time. He was a Bachelor of Arts (1899) and Doctor of Medicine (1903) of Columbia University. In the year 1910–1911 he was Associate Professor of Bacteriology and Immunology at Stanford University. Thereafter he held the chair of Professor of those subjects, from 1911 to 1913 at Stanford University, from 1913 to 1923 at Columbia University, from 1923 to 1935 at Harvard University. From 1935 to 1940 he was Charles Wilder Professor of Bacteriology and Immunology at Harvard. In 1915 he was bacteriologist to the American Red Cross Sanitary Commission to Serbia. An officer of the United States Army Medical Corps from 1917 to 1919, he retired with the rank of Colonel. In 1923 he was League of Nations Sanitary Commissioner to Russia, in 1935 Exchange Professor from Harvard to the Sorbonne, and in 1938 he visited Peiping University Medical College. He was elected a member of the American Philosophical Society in 1937.

As a youth Zinsser fell in love—nothing less—with poetry. Later, when he decided to study medicine, it was a hard decision and all his life long he remained a bacteriologist and a poet, a scientist and a man of letters. The interplay of these conflicting passions—for his devotion to science was no less deep than his love of poetry—and the mature man's resolution of the conflict may be read in Zinsser's last book, "As I Remember Him. The Biography of R.S." (1940), which is his essay in autobiography. The book contains many other things and happily exonerates the writer of a notice of Zinsser's life from the duty of describing a personality that could never be caught by plain description. The point of view of "As I Remember Him" is a compound of French eighteenth century philosophy, romanticism, the German idealism of 1848, scientific objectivity and clinical insight—a compound that hardly another man could have made harmonious. In reading the book one hears echoes I think of Rabelais and Voltaire, and certainly of Sterne. Zinsser also wrote "Rats, Lice and History" (1935), another work of great originality, and he was the author of many poems which he published anonymously. Thus those may still come to know something of him who really wish to do so.

Zinsser's experimental studies were chiefly immunological. They extended over many regions of the broad field, such as the tuberculin reaction, the rôles of altered and unaltered proteins and of non-protein constituents of bacterial cells, and the immuno-

logical aspects of specific diseases such as herpes and especially the typhus fevers. But there was nothing narrow about his work and when he studied a disease he turned his attention fruitfully and with intense interest to every aspect: etiology, transmission, pathology, epidemiology, as well as immunology.

For all his breadth of interest Zinsser at work in the laboratory was, first of all, a proficient specialist in his field and there his breadth chiefly acted to intensify and to amplify his incomparable personal influence on students and collaborators. This influence was further intensified by a most uncommon association of intense devotion to duty and intense belief in and love of pleasure.

Zinsser's researches were interrupted by effective and fruitful work for the Red Cross, by his military service, and by his visit to Russia for the League of Nations. Nevertheless, he harvested a big crop of experimental work, and his work has come to be regarded by all bacteriologists as a great contribution to the subject. Not many years ago he used to say with undue modesty that in experimental work he had never hit the bull's-eye. But during the last years of his life, with all his modesty and severe self-criticism, he could no longer feel dissatisfied with the results of his work. With the work itself I feel sure he had not ever been dissatisfied. I have never known a man's success in research give greater or wider pleasure to others.

Such a man could hardly fail to be a good teacher of medical students, and this he was. He taught well and truly. He brought the subject to life, but above all, as a member of one of the last classes he taught has said: "He had the unusual ability to create the will to learn, . . . is it not well known that all education is self-education in the last analysis? It is not by precept but by example and encouragement that men are taught, and it was Dr. Zinsser's great gift to be able to share and to impart his enthusiasm to his students."

Zinsser was the author of two textbooks: "Text-Book of Bacteriology" (1911), "Resistance to Infectious Diseases" (1914). To these he devoted much labor and put them through many editions in order to keep them up to date. I think it is safe to say that this laborious task was performed only from a sense of duty, duty to himself to remain master of a field at a time when thorough and detailed information seemed to him indispensable because the

subject was so loosely organized, and a spontaneously assumed duty to his pupils and to the medical community.

The two sides of the man are probably best attested by the affection and deep feeling of comradeship of his many friends, who included all sorts and conditions of men, and by the sentiments of admiration, loyalty, gratitude and devotion of his pupils and collaborators. Since his death the world has learned something of his gallant courage.

Hans Zinsser was married in 1905 to Ruby Handforth Kunz of New York. Mrs. Zinsser, a daughter and a son survive.

L. J. Henderson.

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